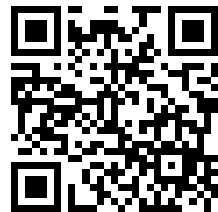
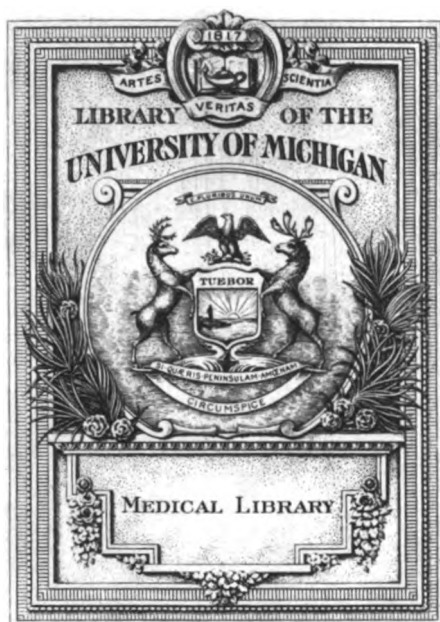

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EDITED BY
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REPORTS OF THE COMMISSION APPOINTED BY THE
ADMIRALTY, THE WAR OFFICE, AND THE CIVIL
GOVERNMENT OF MALTA, FOR THE INVESTIGA-
TION OF MEDITERRANEAN FEVER, UNDER THE
SUPERVISION OF AN ADVISORY COMMITTEE OF
THE ROYAL SOCIETY.

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(Continued from page 645, vol. vi.)

MEDITERRANEAN FEVER IN GOATS, COWS, AND OTHER
ANIMALS.

BY STAFF-SURGEON E. A. SHAW.

Royal Navy; Member of the Mediterranean Fever Commission.

I.—GOATS.

A.—*Experimental.*

To determine experimentally to what degree goats, which are so numerous in Malta, are susceptible to Malta fever, I determined, in July, 1904, to inject cultures of *Micrococcus melitensis* subcutaneously into these animals. Thinking that possibly there might be a difference of susceptibility between the mature and immature animal, I began with experiments on a goat and a kid. On July 30th, 1904, a female goat, two years old, and a female kid, three months old, were purchased, their blood was examined for agglutination reaction to *M. melitensis* (which was found to

2 Reports of the Commission on Mediterranean Fever

be nil), and they were kept under observation for a week. They were then dealt with as follows¹:—

Experiment 1.—Goat, ♀. July 30th, 1904, no agglutination reaction; temperature normal, practically between 101° and 102° F., till August 8th, 1904. Injected subcutaneously at noon of that day into left flank an emulsion of the six-day growth of *M. melitensis* on six agar slopes, second generation, from spleen of human fatal case. This caused a rise of temperature of 3·8° F., from 102° to 105·8° F. on the 9th, and 107·2° on August 10th, then gradually falling back to normal by August 14th.

Agglutination.—Agglutination reaction was first present on August 13th, 1 in 30; rising to 1 in 200 on August 14th, and 1 in 1,800 on August 20th, on which date the goat received a second injection of the growth from four similar agar slopes of *M. melitensis*, which caused a similar rise of temperature for three days. On August 29th it received a third injection of emulsified growth from four more slopes. On August 30th the agglutination reaction was 1 in 2,200, and on September 5th, 1 in 3,200. All these were visible under $\frac{3}{8}$ -in. objective in fifteen minutes.

Urine.—This was plated daily, after having been drawn off into a sterile vessel by a sterile catheter, which I passed myself from August 25th to September 6th, $\frac{1}{2}$ cc. of urine being distributed over the surface of glucose-nutrose-litmus-agar contained in Petri dishes, which were incubated for six days at 37° C. On September 6th, 1904, I went on three weeks' leave. On my return experiments were resumed by me on September 30th. A fourth subcutaneous injection of *M. melitensis* growth from six agar slopes as before was made on October 10th, with the idea of giving the goats' kidneys plenty of the parasite to excrete. The experiment was continued till October 31st, and was then given up, no *M. melitensis* having been at any time recovered from the urine of this animal.

Milk.—This was first plated for recovery of possible *M. melitensis* on August 28th, 1904, but on September 1st the plates were found to be completely overgrown with a *Staphylococcus*, and on centrifugalising the milk from each udder and making film prepara-

¹ [It should be stated that the first of these experiments was briefly described by the author in the manuscript of the Report by him published in the first part of the Reports of this Commission (March, 1905), but the paragraph was deleted at his request, as the observations were, in his opinion, still incomplete, though he recognised and stated that the "goats, which are extremely numerous in Malta, might possibly be instrumental in transmitting the infection of Malta fever."—SEC. R.S.]

tions from the deposit, I recognised pus in the milk from each udder. On August 28th, also, feeding experiments with the milk of this goat were commenced on a healthy monkey (No. 61), a stomach tube being passed and 1 oz. given on this date, 2 ozs. on August 29th, 4 ozs. on the 30th, and 4 ozs. on the 31st; but such severe diarrhoea was developed that no more milk was given after the last date. This monkey, unfortunately, succumbed on September 4th. The usual inoculations were made from its organs and heart's blood into broth, and on to agar slopes, but no *M. melitensis* was recovered. The milk of this goat was examined from time to time, but the pus persisted till April 25th, 1905, by which time the milk was "drying up." It may be noticed in passing that suppurative mastitis is by no means infrequent amongst goats in Malta, and causes, from time to time, outbreaks of illness amongst children (see *Health Reports of Malta*). In June, 1905, the secretion of milk had practically ceased and pus was no longer present in the altered secretion, now thick, ropy, brownish and gelatinous, which, on being plated on June 24th, yielded colonies of *M. melitensis* in abundance.¹

Blood.—The agglutination reaction continued to increase, being 1 in 3,200 on September 30th, 1904, and 1 in 4,500 on October 18th. It then began to diminish, being 1 in 3,000 on November 1st, 1904, 1 in 3,000 on January 3rd, 1905, 1 in 3,000 on February 27th, 1905, and after this stationary period going down to 1 in 2,000 on April 25th, 1905, and 1 in 1,500 on June 12th, 1905.

M. melitensis was recovered from the blood (5 cc.) of the jugular vein on November 7th, 1904, and again from the blood of the same vein on June 27th, 1905.

Experiment 2.—Goat, juv. The kid of three months, purchased at the same time as the goat, received injections of *M. melitensis* on the same dates as the goats, but only in half the quantities.

Its urine was plated on the same days above detailed for the goat, but it never yielded any *M. melitensis*. Its agglutination reaction was similarly examined with the following results:—

1904—

July	30	..	..	..	..	..	Nil
August	14	..	..	..	..	..	1—200
"	20	..	..	..	..	..	1—200
"	30	..	..	..	..	..	1—1,800
September	5	..	..	..	..	..	1—3,200
"	30	..	..	..	..	..	1—3,200

¹ [Major Horrocks had previously recovered *M. melitensis* from apparently normal goats, and had shown the plates to Staff-Surgeon Shaw.—SEC. R.S.]

4 Reports of the Commission on Mediterranean Fever

1904—October	11	..	..	..	..	1—5,500
„	18	..	..	..	..	1—5,000
„	25	..	..	..	..	1—2,000
November	1	..	..	..	..	1—3,000
1905—						
January	3	..	..	..	..	1—2,000
February	27	..	..	..	..	1—1,500
April	25	..	..	..	..	1—1,500

These figures follow closely those obtained from the goat, but rise somewhat higher in degree. *M. melitensis* was recovered from the blood of the kid in November, 1904, and in June, 1905.

From an inspection of the accompanying charts it will be seen that the rise of temperature following each injection is only temporary, lasting but three or four days, thus decidedly differing from the prolonged wave of fever produced in monkeys by a similar procedure, and suggesting a sort of racial tolerance of this infection on the part of the Maltese goat. It was thus proved by the development of a high agglutination reaction in August, 1904, and by the recovery of living *M. melitensis* from the blood in November, 1904, that the goat is at least experimentally susceptible to Mediterranean fever.

B. Natural.

Dr. Zammit, in June, 1905, found that the blood of four goats (out of six purchased for further experimentation) reacted to *M. melitensis* at the time of purchase. This observation having been confirmed by Major Horrocks and myself, and the micro-organism having also been recovered from the milk of one of these animals, the question of the agency of the goat in diffusing the *M. melitensis* was brought from the domain of speculative experiment into the range of everyday life.¹ And after discussing the matter with Deputy Inspector-General Bentham, of the Naval Hospital at Bighi, we decided that I should at once begin an examination of all the goats supplying milk to this hospital.

The method of procedure adopted was as follows: The goats were taken in batches of 12 to 16 at a time. The milk contractor's son took down in Maltese the name and description of each goat,

¹ [Major Horrocks states that Dr. Zammit and he found that five of the normal goats reacted, and that he recovered *M. melitensis* from the milk of all of them but one. He remarks, further, that "the fact that the milk of infected goats causes agglutination of the *M. melitensis* was first shown by Zammit, and in the combined paper by Kennedy and myself the reaction is called 'Zammit's test.'" —Sec. R.S.]



6 Reports of the Commission on Mediterranean Fever

which was numbered. A little blood was taken from the goat's ear in a capillary tube for examination for agglutination, and at the same time 40 to 50 cc. of milk were drawn off into a sterile test-tube; to both of these the same number was attached, the intention being to subsequently eliminate all the goats which might be found infected. After examination of the blood for agglutination reaction, the milk of each goat which reacted was centrifuged, and the centrifuged portion was plated on nutrose-litmus-agar, $\frac{1}{4}$ cc. being distributed over the surface of each Petri dish. These were incubated at 37° C., and were then examined for *M. melitensis* colonies in the usual way. Four to six plates were used for each milk thus treated.

The examination was begun on June 29th. Surgeon White-side, R.N., was so good as to collect the necessary material from the goats at times when I was unable to attend, and he also helped with the agglutination reactions. These were done in two stages, the first to eliminate the non-agglutinating bloods (or milks), the second to determine highest dilution giving agglutination of the remainder. All went well for a few days, until the goat-herds, who had all along looked unhappy over the pricking of their goats' ears for blood, broke out into open rebellion, and henceforth we had to be content with only milk. This necessitated either plating every milk or ascertaining the existence of the agglutination reaction with it. I have already mentioned the excretion of agglutinins in the urine (Part iii. of these Reports). It seemed not unlikely that they would be found to be present in the milk of infected animals. I accordingly put up specimens of such milk, centrifuged and uncentrifuged, diluted and undiluted, with freshly-prepared emulsion of *M. melitensis*, in drops on slides in a moist chamber, with controls of normal milk, and left them for an hour. I then examined them under the microscope and found distinct agglutinations with the infected milks, most palpably in the uncentrifuged specimens, the appearance in the centrifuged series being somewhat masked by *débris* of various sorts. When the milk was allowed to stand in the sterile test-tubes for a couple of hours a considerable layer of cream came to the top and a deposit of *débris* gathered at the bottom. By passing a pipette down to the middle of the column, aspirating milk from there, withdrawing the pipette and then breaking off the capillary end of the pipette well above the adherent cream, I could obtain a specimen of milk almost free from *débris* and with relatively few oil globules, in which the presence or absence of agglutination was fairly easily determinable.

This method was, therefore, perforce adopted for the ascertaining of agglutination reaction in the batches of goats examined on July 13th and 14th, a twenty-four-hour limit for contact of diluted milk and emulsion being adopted for determination of highest dilution giving agglutination.

The details of these examinations of the goats supplying milk to Bigi Hospital in June and July, 1905, are subjoined.

June 29th.—Twelve goats examined. Agglutination reaction found in blood of three: No. 4, in a dilution of 1 in 30; No. 8, 1 in 100; No. 10, 1 in 60. Milks of all three centrifugalised, plated and incubated. *M. melitensis* recovered and verified from No. 8 only (49 colonies).

July 3rd.—Second batch of 12 goats examined. Agglutination reaction found in blood of five: No. 4, 1 in 100; No. 5, 1 in 60; No. 6, 1 in 60; No. 8, 1 in 30; No. 9, 1 in 30. Milks of all these five centrifugalised, plated and incubated. *M. melitensis* recovered and verified from No. 5 (38 colonies), and No. 6 (728 colonies).

July 6th.—Third batch of 16 goats examined. Agglutination reaction found in blood of three: No. 1, 1 in 100; No. 3, 1 in 60; No. 14, 1 in 160. Milks of these three centrifugalised, plated and incubated. *M. melitensis* recovered and verified from No. 3 (six colonies).

July 7th.—Fourth batch of 12 goats examined. Agglutination reaction found in blood of three: No. 5, 1 in 30; No. 7, 1 in 30; No. 10, 1 in 30. Milks of these three centrifugalised, plated and incubated. No *M. melitensis* recovered from any.

July 10th.—Fifth batch of 12 goats examined. Agglutination reaction found in blood of six: No. 1, 1 in 60; No. 5, 1 in 200; No. 7, 1 in 200; No. 8, 1 in 60; No. 9, 1 in 60. Milks of these six centrifugalised, plated and incubated. *M. melitensis* recovered and verified from No. 1 (10 colonies) and from No. 7 (seven colonies).

July 13th.—Sixth batch of 15 goats examined. Agglutination reaction found in milk of four: No. 2, 1 in 100 after twenty-four hours' contact in moist chamber; No. 11, 1 in 60; No. 14, 1 in 30; and No. 15, 1 in 30, all under the same conditions. Milks of these four centrifugalised, plated and incubated. *M. melitensis* recovered from No. 2 (15 colonies) and No. 11 (five colonies).

July 14th.—Seventh batch of 12 goats examined. Agglutination reaction found in milk of six: No. 1, 1 in 150 after twenty-four hours' contact in moist chamber; No. 2, 1 in 160; No. 4, 1 in 30; No. 7, 1 in 30; No. 9, 1 in 30; No. 12, 1 in 30. *M. melitensis* was recovered and verified only from No. 4 (two colonies).

8 *Reports of the Commission on Mediterranean Fever*

For convenience of reference these results may be arranged in tabular form, thus :—

Date	Number of goats examined	Number presenting agglutination re-action	Distinguishing No. of the goats of each batch whose milk yielded <i>M. melitensis</i>	Agglutination limit of latter	Number of <i>M. melitensis</i> colonies recovered
June 29 ..	12	3	No. 8.. ..	1 in 100 ..	49
July 3 ..	12	5	(No. 5.. ..	1 „ 50 ..	38
„ 6 ..	16	3	(No. 6.. ..	1 „ 60 ..	728
„ 7 ..	12	3	No. 3.. ..	1 „ 60 ..	6
„ 10 ..	12	6	None	— ..	—
„ 13 ..	15	4	(No. 1.. ..	1 „ 60 ..	10
„ 14 ..	12	6	(No. 7.. ..	1 „ 200 ..	7
„ 15 ..	15	4	(No. 2.. ..	1 „ 100 ..	15
„ 16 ..	12	6	(No. 11.. ..	1 „ 60 ..	5
„ 17 ..	12	6	No. 4.. ..	1 „ 30 ..	2
Totals ..	91	30	9	—	—

Thus 91 goats were examined, of these, 30 presented the agglutinating reaction to *M. melitensis*, and the milk of these 30 was examined culturally for the parasite, this organism being recovered from the milk of nine of them. The implicated animals were eliminated from the herds supplying the Naval Hospital, and the most stringent measures were taken to ensure that all milk entering the hospital gates was forthwith boiled. It will be interesting to see whether any alteration takes place in the future incidence of cases of fever developing in this hospital.

It will be noticed that in these naturally-infected goats the agglutination limit is low, the highest found being 1 in 200, whereas in the experimentally infected animal it was found as high as 1 in 4,500. No indication has been observed of any relation between agglutination value and the number of colonies of *M. melitensis* yielded by the milk.

The number of organisms other than *M. melitensis* found in the milk from these 30 goats varied enormously, though the milk was collected under precisely similar conditions from all. In some cases $\frac{1}{4}$ cc. of milk would contain but two or three organisms, in others they would be present by the thousand. Time did not admit of a detailed examination being made of these.

The infectivity of the milks obtained from the goats which were the subjects of the experiments here detailed was investigated as follows :—

A monkey received from Genoa on July 12th was kept under observation for a week; its temperature was found to be normal

during this period, and its blood did not react to *M. melitensis*. On July 20th the colonies of this micro-organism obtained from No. 2 goat's milk, plated July 13th, were emulsified in a little normal saline solution. The monkey being held on its back, three drops of this emulsion were dropped down each nostril with a capillary pipette. The animal developed a typical attack of Mediterranean fever, its blood gave agglutination reaction to *M. melitensis* first on August 3rd; fourteen days after infection in a dilution of 1 in 30, running up to 1 in 320 on August 6th, and 1 in 960 on August 10th; *M. melitensis* was recovered from its blood during life on August 22nd, and from its lymphatic glands after death on October 8th.

II.—Cows.

As it seemed by no means impossible that cows also might be found to be infected with Mediterranean fever, I determined to investigate this question. Not many milch cows are to be seen in the island of Malta, there being no pasturage for them. Their owners keep them shut up, some of their stables being most scrupulously clean, while others are much the reverse. The cows seldom get outside. There is a considerable demand for their milk, especially on the part of the resident English population, many of whom dislike the taste of goat's milk, while others object to receive milk from an animal which has just previously been lying down in the street with its udders and teats in close contact with the excreta, liquid and solid, of the various animals, higher and lower.

To Mr. A. M. Macfarlane, M.R.C.V.S., Veterinary Surgeon to the Malta Government, who helped me to procure the necessary materials for bacteriological examination, my warmest thanks are due for the kindness with which he took me round to the various farms, used his influence with the owners of the cattle, and personally assisted in collecting the necessary material for examination.

The method of investigation determined on was as follows: At each of the various farms visited blood was taken from the cows, each animal being assigned a number, which was cut deep in Roman numerals into the hair of its back. The samples of blood were correspondingly numbered, and were subsequently examined for agglutination reaction to *M. melitensis*. The numbers of the cows at each farm giving this reaction, were sent with a daily supply of sterilised test tubes to Mr. Macfarlane, who undertook the collection of a daily sample of milk from each of the cows speci-

10 Reports of the Commission on Mediterranean Fever

fied. These milks were received at the laboratory about an hour after they were drawn. They were at once centrifugalised, and the deposit was plated on nutrose-litmus-agar in Petri dishes, three plates to each sample. These were incubated five days at 37° C., and were examined in the usual way for colonies of the micro-organism. The milks were thus treated daily from August 1st to August 24th, 1905, inclusive, with the following results:—

G. F. of Tarzien.—Nine cows, of which three presented agglutination reaction to *M. melitensis* as follows: No. 3, 1 in 30; this being a heifer, no milk was attainable, and no other form of examination was permitted. No. 4 agglutinated *M. melitensis* in a dilution of 1 in 30, and No. 7 in a dilution of 1 in 60. The milks of the two latter were daily plated for twenty-four consecutive days. Cow No. 7 never yielded any colonies of parasite, but these were found in the milk of Cow No. 4 as follows:—

Plates of 7th August 5 colonies of *M. melitensis*.

„	8th	„	7	„	„
„	12th	„	7	„	„
„	16th	„	3	„	„
„	19th	„	40	„	„
„	20th	„	3	„	„
„	21st	„	39	„	„
„	24th	„	19	„	„

none being found on the other days.

F. G. of Hamrun.—Nine cows, of which five presented agglutination reaction as follows:—

No. 1	agglutinated	1 in 30.
„ 4	„	1 in 800.
„ 8	„	1 in 200.
„ 9	„	1 in 30.

Of these, Cow No. 9 was ailing and not yielding any milk. The milks of the others were plated daily. Nos. 1 and 4 never yielded any colonies of *M. melitensis*, which, however, were found in the milk of Cow No. 8, as follows:—

Plates of 11th August, 63 colonies of *M. melitensis*.

„	12th	„	9	„	„
„	13th	„	31	„	„
„	16th	„	23	„	„
„	18th	„	7	„	„
„	19th	„	13	„	„
„	20th	„	231	„	„

none being found on the other days.

S. G. of Hamrun.—Six cows, none of which presented any agglutination reaction.

C. G. of Hamrun.—Three cows, of which only one presented an agglutination reaction in a dilution of 1 in 30. The milk of this animal was daily examined, but never presented any *M. melitensis*.

C. C. of St. Julian's.—Four cows, of which No. 2 presented a high agglutination reaction, this being present in a dilution of 1 in 1,000. Unfortunately this animal happened to be a heifer, so again no further material for bacteriological examination was procurable.

S. M. of Imsieral.—Two cows, neither of which presented any agglutination reaction to *M. melitensis*.

Result.—Thirty-three cows examined. Ten of these presented an agglutination reaction to *M. melitensis*, varying from 1 in 30 to 1 in 1,000. From the milk of two of these cows, *M. melitensis* was isolated.

III.—OTHER ANIMALS.

During the months of July and August, 1905, I examined specimens of blood kindly procured for me by Mr. Macfarlane, M.R.C.V.S., from thirty-one bullocks which were ailing in a vague indefinite sort of way, and which he thought might possibly be infected with Malta fever. Of these, five presented a very faint agglutination reaction. None of these animals had been in the island over three months.

I also examined several times the blood of two dogs similarly suspected. Neither of these presented any reaction to *M. melitensis*.

REMARKS.

The manner in which animals become infected with the virus of Mediterranean fever is a matter of considerable interest and importance. Up to the present all the evidence available points to their food as being the main vehicle of infection. The feeding experiments carried on by Major Horrocks and myself show conclusively that monkeys and goats may be thus infected. Besides the very obvious way of infection of the young through their mother's milk, the successful result of various feeding experiments with food soiled, directly and indirectly, with the urine of two ambulatory cases of Mediterranean fever which I discovered working in the dockyard, and in whose urine living *M. melitensis* was being excreted, indicates another way in which these animals may be infected while feeding. Goats may be seen any day in the streets of the chief city of the Island of Malta, feeding on filth and

12 Reports of the Commission on Mediterranean Fever

rubbish of every possible variety, some of it visibly saturated with urine, animal and human. Among the lower class Maltese, as above stated, workmen have been found who void living *M. melitensis* in their urine, as do a certain number of the infected goats. Thus the path of this manner of infection becomes clear. Having satisfied their hunger in this manner, the goats lie down in the streets to digest their meal, with their teats and udders often in contact with the ordure of the gutters and roads, till they are kicked up by the goat-herd to be milked into the vessel brought to the doors of the adjacent houses by their occupants. It is hence not to be wondered at that these animals frequently suffer also from suppurative mastitis, and give milk containing pus. In the Health Reports of the Malta Government may be seen reports of outbreaks of illness amongst children directly traced to this cause by their medical officers.

With regard to cows, the evidence is not quite so clear. Kept shut up in "shippens," and seldom allowed outside, they have their food brought to them, but as this food is composed of vegetable and other refuse collected from every possible source and situation, it is easy to understand that they can hardly escape from receiving infected food from time to time.

SUMMARY.

(1) The susceptibility of goats to experimental infection by *M. melitensis* was ascertained by me in the summer of 1904, and is here further demonstrated.

(2) The persistence of living micrococci in the blood of a goat for seven months has been proved. The bearing of this observation on the preparation of a therapeutic serum is obvious.

(3) Of ninety-one goats in full milk, thirty were found to have become infected with Mediterranean fever at some time or other, as shown by their agglutinating power on *M. melitensis*. Living examples of the micro-organism were recovered from the milk of nine of these, and its infectivity was demonstrated on a monkey.

(4) Of thirty-three cows examined, ten were found to have become infected with Mediterranean fever, and living *M. melitensis* was recovered from the milk of two of these.

(5) Of thirty-one bullocks examined, five were found to show a faint agglutination reaction, which may indicate that they had become infected with Malta fever.

(6) Of two ailing dogs, thought to be suffering from this fever, neither was found to be infected.

A CRITICAL EXAMINATION OF THE BLOOD OF PATIENTS IN HOSPITAL, TO DETERMINE IF OTHER THAN MEDITERRANEAN FEVER SERA WOULD AGGLUTINATE THE *M. MELITENSIS*.

BY FLEET-SURGEON P. W. BASSETT-SMITH.

Royal Navy.

THE importance of placing beyond doubt the specific character of the agglutination of the *M. melitensis* when brought in contact with the blood serum of patients cannot be over-estimated, either when the test is used for diagnosis, or for controlling experimental work. There have been cases, from time to time, which have led certain diagnosticians to under-rate this modern method of diagnosis. These people would therefore naturally discredit all investigations based on this principle, pointing to cases in which contradictory results have been obtained from the same serum, and to statements that a positive reaction for Mediterranean fever has been met with in other diseases.

Bearing these facts in mind, I have made a careful examination of 150 samples of blood, taken systematically in the wards of Haslar Hospital, for the purpose, if possible, of demonstrating whether or not the serum of patients suffering from a great variety of diseases other than Mediterranean fever would give a reaction likely to render a mistake in diagnosis probable. It is unnecessary to describe fully the technique employed, this being so well known, excepting to say that :—

(1) The tubes containing the blood were centrifugalised, and the clear serum was alone used.

(2) The emulsion was made from an agar culture ten days old of a strain of *M. melitensis* obtained in November, 1905, from the peripheral blood of a patient now in the hospital, and was used living.

(3) The serum dilution of 1 in 30 was made with normal saline solution, using accurately graduated pipettes.

(4) The examination was made both microscopically, with a four-hour limit, and by sedimentation tubes with a twenty-four-hour limit.

(5) Controls were made for each batch of tubes, with a serum that reacted perfectly in dilutions from 1 in 30 to 1 in 1,000.

The whole examinations were made by myself, but the readings were confirmed by independent observers.

The results are tabulated as follows :—

14 *Reports of the Commission on Mediterranean Fever*

Nature of disease	Number of cases tested	Microscopical	Sedimentation
Enteric fever	3	Negative ..	Negative.
Tubercle of lung	12	" ..	"
" testicle	1	" ..	"
" joint	1	" ..	"
Tubercular empyema	1	" ..	"
Pneumonia	5	" ..	"
Bronchitis	2	" ..	"
Bright's disease	3	" ..	"
Hydronephrosis	1	" ..	"
Rheumatism	7	" ..	"
M.C.O.	7	" ..	"
Tonsilitis	3	" ..	"
Dilated stomach, &c.	1	Positive ..	Positive.
Lead paralysis	1	Negative ..	Negative.
Appendicitis	7	{ 2 Positive ..	{ 2 Positive.
		{ 5 Negative ..	{ 5 Negative.
Hemiplegia	1	Negative ..	Negative.
Epilepsy	3	" ..	"
G.P.I.	1	" ..	"
Alcoholism	1	" ..	"
Aneurism	1	" ..	"
Abscess, local	7	" ..	"
" liver	2	" ..	"
" psoas	1	" ..	"
" mastoid	6	" ..	"
Cellulitis	4	" ..	"
Septic thrombosis	1	" ..	"
Otorrhœa	2	" ..	"
Iritis	3	" ..	"
Keratitis	2	" ..	"
Synovitis	1	" ..	"
Herniotomy	5	" ..	"
Hæmorrhoids	1	" ..	"
Varicose veins	1	" ..	"
Ulcers	2	" ..	"
Fractures	10	" ..	"
Wounds	4	" ..	"
Eczema	4	" ..	"
Gonorrhœa	5	" ..	"
Gonorrhœal rheumatism	2	" ..	"
Syphilis 1	16	" ..	"
" 2	7	" ..	"
Normal blood	2	{ 1 Positive ..	{ 1 Positive.
		{ 1 Negative ..	{ 1 Negative.
Totals	150	{ 4 Positive	{ 4 Positive.
		{ 146 Negative	{ 146 Negative.

It will be seen that the blood of 41 pathological conditions was tested, and that in all but four cases there was no evidence of agglutination of the *M. melitensis*. Of these four positive reactions, two appendicitis cases had lately returned from Malta Hospital, and were running a regular, undulant temperature, and had undoubted Mediterranean fever. The third case was a sick berth steward, who

had Mediterranean fever two years and ten months ago. The fourth was a long time in Malta Hospital, where gastroduodenostomy was performed, and though there is no definite temperature chart of Mediterranean fever, I have no doubt that he was, like so many others, infected by the micro-organism there. His temperature is now irregular.

All these examinations, therefore, gave an *absolute negative* to other than Mediterranean fever blood, causing agglutination of the *M. melitensis* in a dilution of 1 in 30. The following points were also investigated with regard to this reaction:—

Will Lower Dilutions give Erroneous Results?—Ten of the already-used samples of blood were tested in dilutions of 1 in 5, 1 in 10, and 1 in 20. In one case only was there any reaction, an abscess of the knee, which agglutinated up 1 in 10.

Are the Agglutinating Properties Destroyed by Keeping the Blood?—Some serum from a tube of blood, which had been taken from a patient in November, 1901, was tested in the same manner.

	Dilution			
	1—10	1—20	1—40	1—200
Microscopic	+	+	+	+
Sedimentation	+	+	+	+
Control, normal blood	—	—	—	—

Result.—Four-year-old blood serum agglutinated perfectly.

Are the Agglutinating Properties Destroyed by Heat?—A portion of the control serum was heated to 60° C. for ten minutes, and tested as before.

Result.—A good reaction, both microscopically and in sedimentation tubes, at 1 in 30 was obtained.

Are Dead Cultures Reliable for any Length of Time?—Using the control-serum, the following dead emulsions made in the laboratory were tested, dilution 1 in 30.

	Micro- scopical	Sedi- mentation.
(1) Agar emulsion of <i>M. melitensis</i> isolated at Haslar, heated to 65° for quarter of an hour, 0.5 per cent. formalin. Made November 9th, 1903	+	+
(2) Agar emulsion from strain, given by Professor Wright, Netley. Made November 8th, 1904	+	+
(3) Agar emulsion, from Haslar, strain 2. Made March 20th, 1903	+	+
Control, normal blood	—	—

Thus dead cultures made here more than two years ago were perfectly reliable, though the reaction is less rapid than when living ones are used.

Reliability of the Agglutination Reaction in Mediterranean Fever.—Here it may be stated at once that, in acute cases, I have found the reaction unmistakable, the serum, in fairly high dilutions, acting on the *M. melitensis* almost immediately, clumping completely, and being generally easily visible with a 1-inch objective. With chronic cachectic cases of more than four months' duration, so commonly met with in Haslar Hospital, it is different, the reaction being often incomplete, slow, and only obtainable in very low dilutions, as shown by the following cases:—

(1) J. W.—Onset of the fever, April, 1904; returned to the Mediterranean in 1905: immediate relapse. In November, 1905, the blood only agglutinated in dilutions of 1 in 10, yet the *M. melitensis* was in the same month isolated from his blood.

(2) J. P.—Onset April 19th, 1905; now intense emaciation and neuritis. In November the blood agglutinated up to 1 in 10; with 1 in 5 the reaction was immediate.

(3) T. S.—Onset August, 1905; great emaciation and neuritis. In November the blood only reacted up to 1 in 10.

From these results, and from a great number of the same kind, I have formed the opinion that, when using the 1 in 30 dilution (if the technique is properly carried out) a positive agglutination reaction may be considered conclusive of Mediterranean fever, past or present. On the other hand, it would not be correct to state that the patient is not suffering from Mediterranean fever when an examination of the blood gives a negative reaction with this dilution. I believe the chief sources of fallacy are—

(1) Faulty technique; incorrect dilutions, too long time, &c.

(2) Faulty cultures; containing false clumps before use, &c.

(3) Faulty observations; mistaking false clumps for true agglutination.

(4) Faulty history; the patient having previously had the disease.

The sedimentation test appears to me to be the least likely to give rise to errors, provided *clear* blood serum is used, and the emulsion be sufficiently strong to give a visible pellet at the bottom of the tube.

(*To be continued.*)

HINTS REGARDING THE MANAGEMENT AND USE OF X-RAY APPARATUS.

(Continued from p. 652, vol. vi.)

BY LIEUTENANT AND QUARTERMASTER F. BRUCE.
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Tubes.—When Prof. Roentgen discovered X-rays the tube he used was of quite a different pattern to that which is advertised at the present day. In fact, had not considerable improvements been effected in its construction very little benefit would have accrued to mankind through the discovery. It is earnestly hoped that finality has not yet been reached, so far as further improvements can be effected, as the tube is one of the most important items of the apparatus. In Dr. Jackson's so-called focus tube we have in the arrangement of the anode the initial principle on which the tube of the present day is constructed. It is true that his tube has been improved upon, nevertheless, it must be admitted that the improvements are only modifications of his original theory.

Very briefly, a tube in which X-rays are generated is a glass bulb or sphere, from which the atmosphere to a very great extent has been extracted by means of a mercury air pump. The glass used in the manufacture of tubes is composed of material offering the least resistance to the passage of the rays. It may not be altogether out of place to state in this part of the paper that the transparency of any given substance to X-rays is in inverse ratio to its density; hence it will be understood why ordinary glass is unsuitable, as, containing lead, it would obstruct to some extent the passage of the rays. Into each end of the tube is sealed a piece of platinum wire. Within the tube these wires terminate at different points. To the extremity of one is attached a disc called the anode, which is fixed at an angle of 45° to the axis of the tube. For reasons which will be explained later, most of the tubes now on the market are provided with anodes made of stout aluminium discs faced with platinum. The second wire is secured to a concave piece of metal called the cathode, which faces the anode in the axis of the tube. The distance between the anode and the cathode should be so adjusted that the converging stream of rays from the latter may not impinge on the surface of the former in absolute focus, a condition which would quickly perforate the disc. If it were possible to obtain a metal sufficiently infusible to withstand the terrific force of the cathodic rays impinging on the anode in absolute focus, improved results would be obtained. The

metals osmium and osm-iridium are certainly superior in that respect to platinum, but their great expense is prohibitive, hence platinum, backed by a stout disc of aluminium to absorb the heat, is now generally used in the construction of the anode. In addition to the electrodes, anode and cathode, a third has been introduced, which is now known to act as a steadier of the vacuum. Its position in the tube is behind the anode, and both are connected externally by a piece of insulated wire.

Outside the tube the ends of the platinum wires are attached to metal caps which are cemented to the glass, and to these loops are fixed for attaching the wires from the coil.

A tube suitable for the production of X-rays must have its exhaustion carried to about one-millionth of an atmosphere, and it is therefore obvious that any variation in quantity of the residual molecules of gas will effect the degree of vacuum, hence its management becomes a matter of primary importance. This variation is a weakness common to all kinds, and is experienced in every-day practice. Various automatic regulating devices, having a certain amount of success, have been tried to overcome this weakness, but we are still far from perfection.

As the results obtained by the operator depend in great part on the selection and management of tubes, it will be necessary to go rather fully into these matters.

In selecting tubes the appearance of the source of radiation on the anode should be carefully noted, and this can only be done when they are working. A very small well-rounded red spot on the platinum betokens a tube which will probably give good definition. Should the spot be large and irregularly shaped, or several spots are apparent, the tube should be rejected. This is only a rough and ready means of testing a tube, but may be generally relied on in the absence of a more accurate method.

The penetrating power of a tube, or in other words, the depth of any given substance through which the rays will affect a photographic plate, is estimated by the distance the secondary current will spark between the discharging points on the coil, in preference to passing through the tube. The distance between the points is termed the alternative spark gap, and its indications are useful in two ways. Firstly, it saves the tube from probable destruction when the current is too strong, and secondly, by noting the behaviour of certain tubes, as evidenced by the spark gap each requires, a ready means of comparison is afforded when selecting tubes for different services. In the following pages, when the resistance of a tube is

expressed in inches, the length of the alternative spark gap is referred to.

Tubes which require a long alternative spark gap to excite them are often spoken of as being "hard," and conversely those requiring a short spark as being "soft." As these terms only convey a general meaning, it is better that the correct resistance should be known, as its length is an important factor in determining the duration of different exposures.

As the tendency of all tubes during use is to increase in resistance, makers, unless otherwise instructed, supply them low, so that they can first be used on easy subjects, such as the hands or feet. It will usually be found that this increase in resistance is fairly rapid, and were it not for the fact that they can be brought down, the active life of a tube would be very brief.

In order to be able to combat to some extent against the variability in resistance, it is necessary to understand a little about the cause. When a tube is excited, that portion of its inner walls opposite the anode receives a terrific bombardment by gas molecules. In time a portion of these become occluded to the glass, resulting in a diminution of the amount of gas necessary to form a medium by which the current can pass between the electrodes. To bridge this space under attenuated conditions necessitates higher power, and if the increasing resistance is not soon checked the secondary current would find an easier path outside the tube between the terminals. This passage of the current along the outer walls is liable to perforate the glass and ruin the tube.

The remedy at our command to lower the resistance in a tube is to drive the occluded gas back into circulation by the aid of heat. At first it will only be necessary to use a spirit lamp, but in doing so the flame must not be allowed to touch the glass and soften it to the destruction of the tube. Occasionally it will be found that the resistance increases when making an exposure, and sparks will pass between the discharging points and also along the outside of the tube, in which case the spirit lamp should be provided with a long insulated handle so that heat may be applied without risk of receiving a shock. The use of a spirit lamp has its limits, beyond which it will not affect resistance to any appreciable extent; but fortunately there is another method of applying heat to some purpose before it is found necessary to send the tube to the makers to be re-exhausted. Place the tubes in a gas or other oven for twenty-four hours with the temperature maintained at about 120° F. On trying them after this treatment it will be found that the resistance has considerably decreased. I have had

experience with tubes with resistances amounting to as much as nine inches, which were reduced to two inches in a single night by this method.

For average work the resistance of a tube need only be from four to six inches. If lower it would be suitable for easy subjects, such as the hands, or when skiagraphing the extremities in children.

Having dealt with the methods for lowering resistance, it is now equally as important to show how it may be temporarily increased. This can be accomplished by arranging an adjustable spark gap in the secondary circuit. It is a matter of astonishment that this contrivance is not more generally used, as its effect on tubes of low resistance is most marked. It, in addition, eliminates to a considerable extent the back discharge in the secondary circuit, thus making it unidirectional. If used with a coil having a platinum interrupter, it will be found that the platinum points do not so readily fuse as without its use, and the light in the tube will be steadier.

Self-regulating Tubes.—Much commendable energy has been expended by makers and others in the attempt to devise a tube having an automatic arrangement by which the resistance in a tube can be regulated. A certain measure of success has resulted from their efforts, as evidenced by the introduction of the self-regulating tubes. They differ in some respects, but all have the same object in view, namely, the expulsion of gas from a given metal by the aid of heat, either by direct application or by the passage of a current of electricity through the metal. A full description of the method of using an improved regulating type of Cox's Record Tube is given in one of the appendices to his list, and to those desirous of a more intimate knowledge of the device a perusal of the directions will prove interesting. Personally, I do not think the advance in this direction has gone so far as to supersede the ordinary tube when carefully used. Besides, they are very expensive, and when it is considered that by a little manipulation in the management of the ordinary kind the vacuum can be controlled, as described in detail, to an appreciable extent, a very decided improvement will require to be introduced before the new idea is universally adopted. In one particular, however, their use is commendable, and that is when administering X-ray treatment therapeutically, when every assistance is desirable to keep the tube at a given resistance throughout the exposure. In this respect the self-regulating type supersedes all others.

In estimating the power of a tube for a given object, the appearance of the bones on a fluorescent screen is of great assistance.

Should the bones appear grey and only slightly less transparent than the flesh, indicates that the tube is only fit for screen work, unless worked in connection with a diaphragm. If, however, the bones appear black and only the flesh transparent, the tube is excellent for photographic work.

Adjustable Spark Gap.—This contrivance can be quite easily arranged on any installation, and consists of a means by which a gap may be introduced in one of the wires leading from the coil to the tube. It should be possible to adjust the length of the gap at will, and may be constructed as follows: Procure a piece of strong glass tubing about twelve inches long, having an internal diameter of about a quarter of an inch. Secure the tubing to the top of a pillar the same height as the coil, and fixed to a firm base. Having previously cut one of the wires at any convenient point, introduce the cut ends into the tubing so that they may meet in the centre. By means of a piece of string firmly secure the wire from the coil to the glass tubing. The wire leading to the tube should be only temporarily secured so that it may be moved at will to regulate the amount of separation between the ends of the wires in the tubing. The alternative spark gap between the discharging points, and therefore the resistance of any tube, can be increased by the separation of the ends of the wires. Although a more elaborate appliance can be obtained, the one described, which has been devised by the writer, has been found to answer all requirements.

Fluorescent Screens.—Were it not for the fact that X-rays possess the power of rendering certain substances fluorescent, their effect would only become apparent on photographic plates. This fluorescent effect enables the eye to see shadows of objects, such as the bones in the hand.

The best screens are coated with barium platinum cyanide, which, being the most sensitive material, gives the brightest light under the influence of the X-rays.

In using a screen the part to be examined is supported between it and the tube. The screen can only be used in a darkened room. In the writer's experience the use of a screen is very limited, and fails to detect such injuries as impacted and sub-periosteal fractures. Preparatory to localising foreign bodies, the use of a screen is of great service in determining the position in which the skiagraph should be taken.

The next paper will be devoted to practical application.

(To be continued.)

SOUTH AFRICAN STOCK DISEASES.¹

By COLONEL DAVID BRUCE, C.B., F.R.S.

Royal Army Medical Corps; President of the Physiological Section of the British Association, 1905.

THE ADVANCE IN OUR KNOWLEDGE OF THE CAUSATION AND METHODS OF PREVENTION OF STOCK DISEASES IN SOUTH AFRICA DURING THE LAST TEN YEARS.

TEN years ago, when I first came to South Africa, I was led to take an interest in the various great stock diseases which do so much damage and so retard the progress of South Africa as a stock-raising country. I thought, therefore, that a good subject for my address, in the centre of the foremost stock-raising Colony of South Africa, would be a review of the work done in advancing our knowledge, during the last ten years, of the causation and methods of prevention of stock diseases in South Africa.

South Africa is particularly rich in animal diseases, every domestic species seemingly having one or more specially adapted for its destruction. Now it is evident that, in an address of this kind, it will be impossible to take up every stock disease, but I think you will agree with me that the following are among the most important:—

East Coast fever; ordinary redwater or Texas fever; biliary fever of horses; malignant jaundice of dogs; nagana or tsetse-fly disease; trypanosomiasis of cattle; rinderpest; horse-sickness; catarrhal fever in sheep; heart-water of sheep, goats and cattle.

Now we may group these diseases in various ways; for example, as in the following table, where they are divided into two main divisions: *A.* division, in which the parasite is known; and *B.* division, in which the parasite is unknown.

A.—PARASITE KNOWN.

I.—Diseases caused by parasites belonging to the genus *piroplasma*:—

- (1) East Coast fever (Koch), *Piroplasma parvum* (Theiler).
- (2) Redwater or Texas fever, *Piroplasma bigeminum* (Smith).
- (3) Biliary fever of horses, mules, and donkeys, *Piroplasma equi* (Laveran).
- (4) Malignant jaundice of dogs, *Piroplasma canis*.

¹ Address delivered before the Physiological Section of the British Association for the Advancement of Science, at Johannesburg, August 29th, 1905.

II.—Diseases caused by parasites belonging to the genus *trypanosoma* :—

- (1) Nagana or tsetse-fly disease, *Trypanosoma brucei* (Bradford and Plimmer).
- (2) Trypanosomiasis of cattle, *Trypanosoma theileri* (Bruce).

B.—PARASITE UNKNOWN.

III.—Diseases caused by parasites which are probably ultra-microscopic :—

- (1) Rinderpest.
- (2) Horse-sickness.
- (3) Catarrhal fever of sheep.
- (4) Heart-water of sheep, goats and cattle.

A.—PARASITE KNOWN.

I.—DISEASES CAUSED BY PARASITES BELONGING TO THE GENUS *PIROPLASMA*.

(1) *East Coast Fever*.

The first important stock disease I would draw your attention to, then, is East Coast fever. This name was given to it by Professor Robert Koch, of Berlin. In the Transvaal the disease is usually called Rhodesian redwater. This term is not a good one, since the disease is not restricted to Rhodesia, nor did it arise there, nor is this a disease similar to the ordinary redwater. Ten years ago, when I first came to South Africa, East Coast fever was unknown in the Transvaal. The first known outbreak occurred only some three and a half years ago, when it appeared at Koomati and Neilspruit, in the Barberton district, and in the east of the Colony. The disease had broken out some time previously in Rhodesia, and the outbreaks in both Colonies were due to infection from Portuguese territory. Although this disease has only been introduced into the country during the last few years, it has already produced an enormous amount of damage among stock, and is probably the most dangerous disease that the people of the Transvaal have to cope with at the present time, and for some years to come.

In the Annual Report of the Transvaal Department of Agriculture there is a most excellent report by Mr. Stockman, the then Principal Veterinary Surgeon, on the work of the veterinary division for the year 1903-1904. A large part of this report is given up to East Coast fever, and I must here express my

indebtedness to Mr. Stockman for much of the following account of this disease. In the same Annual Report there is also an account by Dr. Theiler, the Veterinary Bacteriologist, of the experimental work. Messrs. Stockman and Theiler evidently worked together, and I must congratulate them on the immense amount of good useful work done by them, and I would also congratulate the Government on having had the services of two such accomplished and energetic gentlemen during the late troublesome times. Unfortunately for the Transvaal, Mr. Stockman has accepted the post of Veterinary Adviser to the Board of Agriculture in England, but I have no doubt his successor, Mr. Gray, from Rhodesia, will continue the good work begun by him.

East Coast fever was first studied by Professor Koch at Dar-es-Salaam, in German East Africa, and he at first mistook it for ordinary redwater. It seems to occur as an endemic disease along a great part of the East Coast of Africa, but is restricted to a narrow belt along this coast-line. The cattle inhabiting this region have become immune to the disease, and are, therefore, not affected by it. Cattle passing through the Coast district to the interior, or brought to the Coast from the interior, are apt to take the disease and die. It was by the importation of cattle, therefore, which had passed through the dangerous Coast district, that the disease was introduced into Rhodesia and into the Transvaal.

Nature of the Disease.—This disease only attacks cattle, but in them is an exceedingly fatal malady: in every hundred cattle attacked only about five recover. The duration of the disease after the first symptoms have occurred is about ten days.

The cause of the disease is a minute blood parasite called the *Piroplasma parvum* (Theiler), which lives in the interior of the red blood corpuscles.

Fig. 1 is a representation of the blood from a case of Rhodesian redwater, magnified about a thousand times, showing these small piroplasmata in the interior of the red blood corpuscles.

As in the case of so many of these blood diseases, the organism causing it is carried from the sick to the healthy by means of a

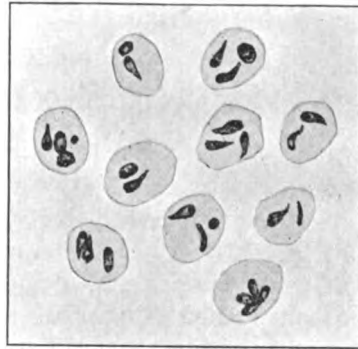


FIG. 1.—*Piroplasma parvum*.

blood-sucking ecto-parasite. In this particular disease the tick which most commonly transfers the poison or living parasite from one animal to another is known as the "brown tick," *Rhipicephalus appendiculatus*. Koch supposed that the common "blue tick" was the agent. The credit belongs to Mr. Lounsbury and Dr. Theiler of having shown that it is chiefly the "brown tick" which acts as carrier; but Theiler has proved that *R. simus* is also able to transmit the disease. Without the intervention of a tick, as far as we know at present, it is quite impossible that the parasite of this disease can be transferred from one animal to another. For example, if we take a quantity of blood containing enormous numbers of these piroplasmata, and inject it into the blood circulation of a healthy animal, the latter does not take the disease. In the same way, if cattle affected by East Coast fever are placed among healthy cattle in a part of the country where none of these "brown ticks" are found, the disease does not spread. It is evident, therefore, that some metamorphosis of the parasite must take place in the interior of the tick, and this new form of the parasite is introduced by the tick into a healthy animal, and so produces the disease. In this particular disease the virus or infective agent is not transmitted through the egg of the tick, as is the case in some of these parasitic diseases, but only in the intermediate stages of the tick's development; that is to say, the larva which emerges from the egg of the tick is incapable of giving the disease. What happens is this: the larva creeps on to an infected animal and sucks some of its blood. It then drops off, lies among the roots of the grass, and passes through its first moult. The nymph, which is the name given to the creature after its first moult, is capable of transferring the disease to a healthy animal; that is to say, if it crawls on to a healthy animal and sucks blood from it, it at the same time infects this healthy animal with the germ of East Coast fever. In the same way, if a nymph sucks infected blood from a sick animal, it is able, after it has moulted into the adult stage or imago, to give rise to the disease if placed, or if it crawls, upon a healthy animal.

The Life-history of the "Brown Tick."—Fig. 2 represents the three stages of the life-history of the brown tick: (1) the larva; (2) the nymph; (3) the adult male before feeding; (4) the adult male after feeding; and (5) the adult female. The outline represents the size she becomes after feeding. All these figures are magnified four times. The eggs are laid on the surface of the ground by the adult females, who deposit several thousands at a time; and these

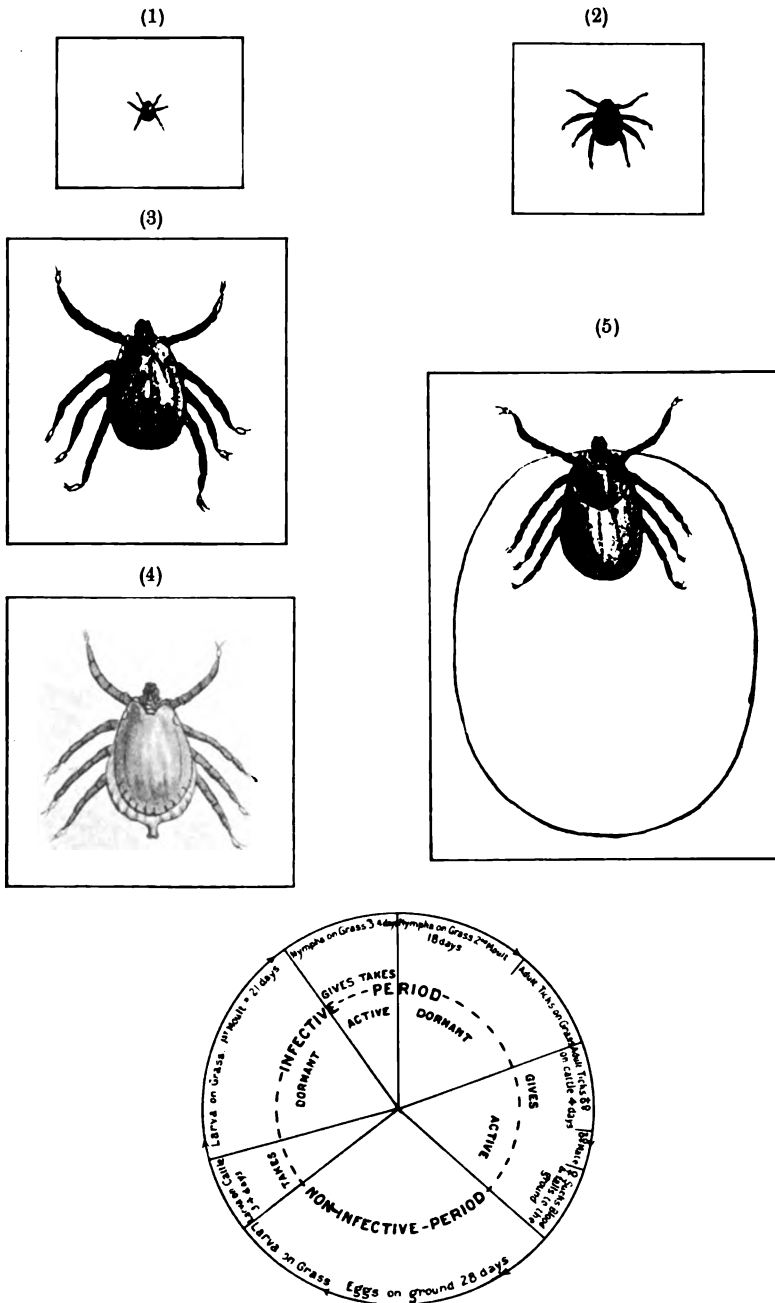


FIG. 2.—Life Cycle of Ticks with three Hosts. East Coast Fever: *Rhipicephalus appendiculatus*, seventy-three days; *Rhipicephalus simus*. Heart-water: *Amblyomma hebraeum*.

hatch out naturally, if the weather is warm and damp, in twenty-eight days. But this period of incubation of the eggs may vary very greatly owing to differences in temperature. Immediately after the larva is born it crawls to the summit of a blade of grass or grass stem, and there awaits the passage of some animal, to which it clings, and having secured a favourable position, starts to suck the ox's blood. It remains on the ox for some three or more days, when, having filled itself with blood, it drops off and lies among the grass. The first moult, under favourable conditions, takes twenty-one days, when the nympha emerges. In the same way the nympha gets on to an animal and fills itself with blood. As a nympha it also remains on the animal for three or four days. It again drops off into the grass, and at the end of eighteen days emerges from its second moult as the perfect adult male or female. The males and females again crawl on to an ox, where they mate. After this the female tick ingests a large quantity of blood, which is meant for the nourishment of the eggs, and again drops off, sometimes as early as the fourth day, into the surrounding grass. After about six days she lays her eggs in the ground, and the cycle begins again.

These ticks are very hardy, and in the intermediate stages can resist starvation for long periods, so that a larva, nympha, or adult tick may remain perched at the end of a blade of grass for some months without finding an opportunity of transferring itself to a suitable animal. On this account it comes about that even if all infected cattle are removed from a field the ticks in that field will remain capable of transferring the infection to any healthy cattle which may be allowed into this field for a period of about a year. At the end of a year or fifteen months the infective ticks are all dead, and "clean" cattle may be allowed into the field without any risk. If one takes these facts into consideration it will be seen that a single ox may spread this disease for a distance of some 200 miles, if trekking through the country at the average rate of ten miles a day. For example, an ox is infected by a tick: for fourteen days the animal remains apparently perfectly well; it has no signs of disease, nor has it any fever. It is capable of doing its ten miles' trek a day. At the end of fourteen days the temperature begins to rise, and the animal begins to sicken with the disease, but for the next six days the ox is, as a rule, able to do its ordinary day's march. During most of this time the "brown ticks" have been crawling on to this ox, becoming infected, and dropping off every three or four days. It can readily, therefore, be seen how much

mischievous a single infected animal can do to a country between the time of its being infected by the tick and its death some twenty-four days later. As a matter of experience, however, the disease has never been found to make a jump in this way of more than fifty or sixty miles, as, of course, it is very rare that a transport rider will take his oxen more than that distance during the twenty days.

During 1904 some 15,000 cattle died of this disease. When one considers the value of these animals, it is evident that money spent on the scientific investigation of the causes and prevention of stock diseases is money well spent.

Methods of Combating the Disease.—During the last three years an immense amount of work has been done in the elucidation of this disease—how the animals are infected, how the poison is spread from the sick to the healthy, and so on. In 1903 Professor Koch was asked by the South African Colonies to study this disease, in order to try to find some method of artificial inoculation or some other means of prevention. He did his work in Rhodesia, and especially directed his energies towards discovering some method of preventive inoculation. At first it was thought that he would be successful in this quest, as in his second report he announced that he had succeeded in producing a modified form of the disease by direct inoculation with the blood of sick and recovered animals. As everyone is aware, the only method of conferring a useful immunity upon an animal is to make it pass through an attack of the disease itself, so modified as not to give rise to above a few deaths in every hundred inoculated. This is the method that has been employed in such diseases as rinderpest, anthrax, pleuropneumonia, and many others. The great difficulty in this disease in finding a method of preventive inoculation, is the fact that the blood of an affected animal does not give rise to the disease in a healthy one when directly transferred under the skin of the latter. It is only after its passage through the body of the tick that the parasite is able to give rise to the disease in a healthy animal. It is evident, on the face of it, that it must be difficult to so modify the parasite during its sojourn in the tick's body as to reduce its virulence to a sufficient degree.

Professor Koch, in his third and fourth reports, recommended that cattle should be immunised by weekly or fortnightly inoculations of blood from recovered animals, extending over a period of five months. Even though this method of Koch had given the desired result, viz., that it rendered the inoculated cattle immune to the

disease, it is evident that the method itself can hardly be made a practicable one on a large scale in the field. The expense and trouble of inoculating cattle on twenty different occasions would be very great. It is apparent now that Professor Koch fell into error through mixing up East Coast fever with ordinary redwater. His plan of preventive inoculation was, however, tried on a large scale in Rhodesia by Mr. Gray, now the P.V.S., Transvaal, and found to be useless. At present, therefore, we must look to some other means of preventing the disease and driving it out of the country than preventive inoculation.

Dipping.—Much can be done to prevent the spread of this disease by ordinary methods. For example, in the case of Texas fever in Queensland, dipping cattle in solutions of arsenic or paraffin, in order to destroy the ticks, has met with very fair success; but in the case of this disease we cannot expect to get as good results as in the case of Texas fever. The species of tick which conveys Texas fever remains on the same animal through all its moults, instead of falling to the ground between each different one. If it is not possible to spray or dip cattle oftener than once in ten or fifteen days, it is evident that ticks may crawl upon such animals, become infected, and drop off every three or four days, and so escape destruction by the dipping solution. At the same time, every infected tick that is killed by spraying or dipping operations is a source of infection destroyed.

Fencing of Farms.—Again, the fencing of farms must also be useful in the same direction. As the ticks do not travel to any extent when they fall among the grass, it is evident that the cattle on a clean farm which is properly fenced will not become infected by this disease, although all the country round about should be infected. This fencing of farms and subdividing the farm itself into several portions, is a most important factor in the prevention of contagious diseases amongst stock. It is, of course, impossible that this can be done at once, as the expense would be prohibitive.

Moving Cattle from Infected Pasture to "Clean" Pasture.—From a study of this disease and a study of the life history of the tick, it is evident that, by a combination of dipping or spraying the cattle, slaughtering the sick, and moving the apparently healthy on to "clean" veldt, an outbreak of this disease may be nipped in the bud without much loss to the stock.

Stamping out the Disease.—In May, 1904, an inter-Colonial Conference, held at Cape Town, resolved that the only effective method of eradicating East Coast fever is to kill off all the cattle

in the infected areas, and to leave such areas free of cattle for some eighteen months. By this means all the centres of infection would be destroyed, and at the end of eighteen months, as all the infected ticks would be dead, it is evident that the disease would be completely stamped out. There is no doubt that this drastic method would be the quickest and most complete one of getting rid of this extremely harassing disease. If compensation were given, it could be done at a cost of, say, a quarter of a million. The Government decided, however, that on account of the difficulty of carrying out such a scheme another policy had to be considered. This policy provides for the fencing-in of infected farms, places, lands or roads, on generous terms; the compulsory slaughter of stock with compensation in the case of isolated outbreaks; the removal of all oxen from infected or suspected farms; and, lastly, the stabling of milch cows in infected areas. It is quite evident that under this policy the final stamping-out of the disease will be a much slower process than if the more effective scheme of compulsory slaughter of all cattle on infected areas had been carried out. The benefits, however, from the modified scheme are undoubted; and if carried out thoroughly and intelligently for a period of several years, will probably result in the stamping-out of the disease.

Allow me to sum up in regard to the advance in our knowledge of this important stock disease during the last ten years. Ten years ago nothing was known. Now the causation of the disease has been made out very fully; the parasite that causes it is known; the ticks which carry the infection are known. Although no method of conferring immunity on healthy cattle has been found out, or any medicinal treatment discovered which will cure the sick animal, yet our knowledge of the life-history of the parasite and the tick enables regulations to be framed which, if patiently carried out, must be crowned with success.

(To be continued.)

THE MUTUAL MOBILITY BETWEEN THE SKIN AND DEEPER STRUCTURES, AND ITS RELATION TO BULLET WOUNDS.

By G. LENTHAL CHEATLE, C.B., F.R.C.S.ENG.

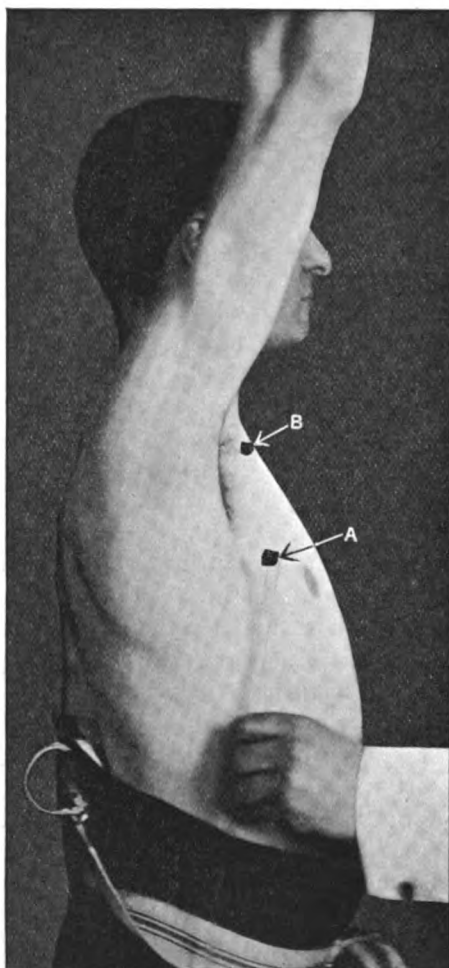
THE following observations will demonstrate the impossibility of determining, from the position of the skin wounds alone, what deeper structures have been either hit or missed by a bullet in its transit through the body. It is necessary to call attention to three points :—

(1) That the skin moves normally over deeper structures. This movement of the skin is more marked in some parts than in others. The range of the skin's movement is most marked about the scapula behind, and the folds of the axilla in front. In the accompanying photograph two black points can be seen—A and B. A was the fixed point and B was a mark on the skin. When the arm was in the normal anatomical position, the two marks, A and B, were opposite one another ; but when the arm was raised above the head, as shown in the illustration, the mark on the skin B moved upwards from the fixed point A about five inches. No movement of the trunk was allowed. It can be easily appreciated that if a bullet were to hit a man at B with his arm raised, the skin at B would be lowered to the position A when his arm was lowered, and hence give rise to the erroneous impression that the thorax was penetrated at A, when really the thorax would have been entered at B. The nipple moves upwards about one and a half to two inches when the arm is raised. The mobility of the skin in these regions may explain many otherwise inexplicable escapes of the heart in bullet wounds of the chest. Again, a man whilst in the act of "raising his eyebrows" might be hit by a bullet which entered the base of his skull and injured his brain. When the skin resumed its normal position the wound would be lowered half an inch to an inch, so that an examining surgeon would be led to hope that the brain had escaped, whereas, in reality, the man was probably fatally wounded.

(2) That the deeper parts normally move under the overlying skin, which, although stretched, may remain more or less stationary. To demonstrate this fact, make an ink mark on the skin covering the centre of the patella when the man is standing upright in the normal position. Then make the man bend his knee to the limit

32 *Mutual Mobility between the Skin and Deeper Structures*

of flexion, and observe the relation of the patella to the ink mark; the bone will be seen to have moved so far downwards that the mark does not cover it at all. Hence it may be said that if a man's leg were hit by a bullet at this point when his knee was completely



flexed his patella would escape, although it would appear when his leg was straightened that the patella and centre of the joint must have been penetrated. The same kind of experiment can be demonstrated in the region of the olecranon process; and the iliac crest

can be shown to move beneath the skin by tilting the pelvis well upwards or downwards. The abdominal viscera can also be demonstrated to move within the abdominal cavity. To open the abdomen of a patient in the Trendelenberg position is perhaps the best way of showing the capacity of the small intestines to leave Douglas' pouch and occupy higher regions. A man wounded through the pelvis, when in a corresponding position, might escape injury to his small intestines. In fact, at Modder River, during the Boer War, I had under my care a young soldier who had been wounded through the pelvis as he was crawling down the river bank at Paardeberg in the act of getting water. His rectum was penetrated and fæces had escaped into the lower part of his abdominal cavity. The probability is, that his small intestines would have escaped injury even if the bullet had directly traversed Douglas' pouch, because he was practically in the Trendelenberg position.

(3) That when the skin is fixed by a belt, strap, or by a man leaning against a hard object, the underlying parts move about beneath the skin so fixed. It seems to me it must be admitted on all hands that the only way to discover what are the viscera struck by a bullet is to search for them by a direct *post-mortem* examination, and practically to regard the positions of the skin wounds as data liable to lead to error. The mobility of the skin over more or less fixed deeper structures, and the subcutaneous mobility of the deeper structures beneath a more or less fixed skin, renders valueless any observations of this kind that are based upon the position of skin wounds.

I was led into these experiments after a criticism by Surgeon-General W. F. Stevenson, C.B., which was made upon a case I ventured to publish in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, January, 1905, in which he based his attack upon the positions of the skin wounds, and imagined that on those grounds alone he could cast doubt upon a careful *post-mortem* examination made by myself and others.

ON THE DATE OF APPEARANCE AND DURATION OF
BACILLUS PESTIS IN THE PERIPHERAL BLOOD
 OF CASES OF BUBONIC PLAGUE IN INDIA.

BY CAPTAIN E. D. W. GREIG.
Indian Medical Service.

(1) *Introductory*.—The work which forms the basis of this paper was done by the author in Bombay during the height of the plague season of 1902, but the results of the investigation were not published at the time. The trend of recent research in India, however, points to blood-sucking insects, fleas, as being one of the most important, if not the only means, by which plague is spread; accordingly additional significance is added to this investigation, and makes it desirable that the facts ascertained be now placed on record. The sum total of our knowledge of the subject in India at the time the investigation was undertaken is summed up by the late English Plague Commission, who, in writing of the presence of *Bacillus pestis* in the blood of plague cases, say, "This invasion would seem to occur only in serious cases, and to occur in those for the most part only shortly before death." From this statement it will be seen that there was room for a further exploitation of this line of investigation to more sharply focus our conceptions on this subject.

The following plan of work was adopted in this research. The observations were made in cases on the first day of their admission into hospital, and only on those cases in which the total duration of the disease did not exceed three days. This was done in order to determine the presence or absence of the *B. pestis* in the blood at the earliest possible date after the onset of the disease. The site of the bubo was noted in every case. The after history of each case was followed, the date of death or discharge from hospital being recorded. The bacilli were determined in the blood by the following method. Each day a sufficient number of small flasks, each containing exactly 50 cc. of sterile nutrient broth, with a few drops of oil added, was taken to the hospital. The skin of the patient's forearm was disinfected and exactly 1 cc. of blood was taken from a superficial vein by means of a syringe previously sterilised. The blood was at once transferred to a small flask. The blood and broth were thoroughly mixed, the resulting dilution being 1—50. The flasks were taken back to the laboratory and

kept at room temperature. The appearance of stalactite growth was looked for and noted. From the broth flasks sub-cultures on dry agar were made. These were examined macroscopically and microscopically, and the effect of the injection of the cultures into various animals, monkeys, rats and guinea-pigs, was noted. By the above procedures it was possible to determine with certainty the presence or absence of *B. pestis* in the sample of blood of the cases of bubonic plague.

(2) *In what percentage of cases of bubonic plague in the early stage of the disease is B. pestis found in the circulating blood?*

The blood was examined by the method above described in 132 cases of bubonic plague.

The following table shows the number of cases examined, the stage of the disease, and the presence or absence of *B. pestis* in the blood in these cases:—

Number of cases examined	Stage of disease	<i>B. pestis</i> in blood	
		Present	Absent
132	Within first three days	79 = 59·8 per cent.	53

(3) *What is the case mortality in cases of bubonic plague in which the B. pestis is found in the peripheral blood and the case mortality in cases in which it is not found?*

The following table shows the presence or absence of *B. pestis* in the cases examined and the case mortality:—

Total cases examined	<i>B. pestis</i> in blood.	Number of fatal cases	Number of recoveries
132	79 cases, present . . 53 cases, absent . .	77 = 97 per cent. 23 = 43 ,,	2 30

(4) *What is the duration of the period before death that B. pestis exists in the blood of cases of bubonic plague?*

The blood was examined at the earliest possible opportunity in the course of the disease, and the date when the organisms were found as well as the date of death were recorded, and the interval between the two dates gave the approximate period during which the *B. pestis* existed in the blood. The period was probably

36 *Date of Appearance and Duration of Bacillus Pestis*

longer than that recorded, as doubtless the invasion of the blood must have occurred some time before the bacilli were determined, on examination, to be present. It will be seen that the duration of the period varies greatly. In some cases only twelve hours, in others as long as ten days. During this interval blood-sucking insects, taking up blood from patients, would also ingest the *B. pestis* and so become infected. Just as it is of great importance to determine the percentage of cases of trypanosomiasis in a population in relation to the transmission of the trypanosoma by the tsetse-fly, so it is of equal importance in bubonic plague to work out the number of cases which show blood infection, and to determine the duration of this period of infection in view of the probable transmission by fleas.

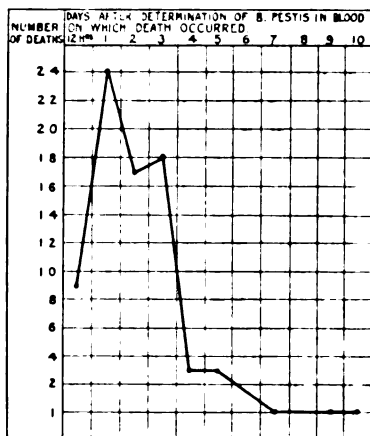
The following table shows the number of cases of bubonic plague in which *B. pestis* was recovered from the blood, the date on which the observation was made, the date of death of each case, and the duration of the infective period :—

Serial number of case	Date of observation	<i>B. pestis</i> in blood	Date of Death	Duration of infective period
1	6.3.02	+	7.3.02	24 hours.
2	6.3.02	+	9.3.02	72
3	10.3.02	+	13.3.02	72 "
4	10.3.02	+	12.3.02	48 "
5	10.3.02	+	11.3.02	24 "
6	10.3.02	+	12.3.02	48 "
7	10.3.02	+	10.3.02	12 "
8	11.3.02	+	14.3.02	72 "
9	11.3.02	+	12.3.02	24 "
10	11.3.02	+	12.3.02	24 "
11	11.3.02	+	14.3.02	72 "
12	12.3.02	+	14.3.02	48 "
13	12.3.02	+	13.3.02	24 "
14	12.3.02	+	15.3.02	72 "
15	13.3.02	+	14.3.02	24 "
16	13.3.02	+	15.3.02	48 "
17	13.3.02	+	14.3.02	24 "
18	13.3.02	+	13.3.02	12 "
19	13.3.02	+	14.3.02	24 "
20	13.3.02	+	16.3.02	72 "
21	13.3.02	+	14.3.02	24 "
22	14.3.02	+	16.3.02	48 "
23	14.3.02	+	16.3.02	48 "
24	14.3.02	+	15.3.02	24 "
25	14.3.02	+	15.3.02	24 "
26	14.3.02	+	15.3.02	24 "
27	14.3.02	+	16.3.02	48 "
28	14.3.02	+	14.3.02	12 "
29	15.3.02	+	19.3.02	96 "
30	15.3.02	+	18.3.02	72 "

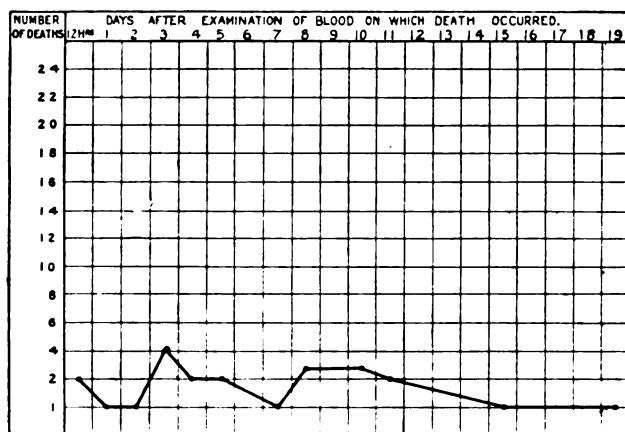
Serial number of case	Date of observation	<i>B. pestis</i> in blood	Date of death	Duration of infective period
31	15.3.02	+	15.3.02	12 hours.
32	15.3.02	+	18.3.02	72 "
33	15.3.02	+	16.3.02	24 "
34	15.3.02	+	18.3.02	72 "
35	15.3.02	+	18.3.02	72 "
36	15.3.02	+	17.3.02	48 "
37	17.3.02	+	18.3.02	24 "
38	17.3.02	+	23.3.02	120 "
39	17.3.02	+	20.3.02	72 "
40	17.3.02	+	20.3.02	72 "
41	17.3.02	+	18.3.02	24 "
42	17.3.02	+	17.3.02	12 "
43	18.3.02	+	28.3.02	240 "
44	18.3.02	+	20.3.02	48 "
45	18.3.02	+	19.3.02	24 "
46	18.3.02	+	20.3.02	48 "
47	19.3.02	+	19.3.02	12 "
48	19.3.02	+	21.3.02	48 "
49	19.3.02	+	24.3.02	120 "
50	21.3.02	+	30.3.02	216 "
51	21.3.02	+	23.3.02	48 "
52	25.3.02	+	28.3.02	72 "
53	25.3.02	+	26.3.02	24 "
54	25.3.02	+	25.3.02	12 "
55	26.3.02	+	30.3.02	96 "
56	26.3.02	+	29.3.02	72 "
57	26.3.02	+	27.3.02	24 "
58	26.3.02	+	28.3.02	48 "
59	26.3.02	+	27.3.02	24 "
60	28.3.02	+	31.3.02	72 "
61	28.3.02	+	29.3.02	24 "
62	28.3.02	+	31.3.02	72 "
63	28.3.02	+	29.3.02	24 "
64	31.3.02	+	1.4.02	24 "
65	31.3.02	+	2.4.02	48 "
66	2.4.02	+	3.4.02	12 "
67	2.4.02	+	4.4.02	48 "
68	2.4.02	+	5.4.02	72 "
69	3.4.02	+	5.4.02	48 "
70	3.4.02	+	4.4.02	24 "
71	5.4.02	+	7.4.02	48 "
72	7.4.02	+	10.4.02	72 "
73	7.4.02	+	11.4.02	96 "
74	7.4.02	+	14.4.02	168 "
75	7.4.02	+	12.4.02	120 "
76	17.3.02	+	18.3.02	24 "
77	17.3.02	+	17.3.02	12 "

The following chart represents the number of fatal cases of bubonic plague in which *B. pestis* was found in the blood, and the date, after the determination of the organisms in the blood, at which death took place, thus showing the period during which the blood contained the *B. pestis* in these cases :—

38 *Date of Appearance and Duration of Bacillus Pestis*



The following chart represents the number of fatal cases of bubonic plague in which *B. pestis* was not determined in the blood, and the date after the examination on which death occurred : —



A PLEA FOR INDIAN SERVICE FOR ALL RANKS OF THE CORPS.

By MAJOR W. TIBBITS.

Royal Army Medical Corps.

MOST of us are struck, on first arrival in India, with the change of system of medical organisation as distinguished from what we have been accustomed to on Home or Colonial Service. Taking firstly *personnel*, we find the Indian Subordinate Medical Department, the Army Hospital Corps and the Army Bearer Corps; lastly, there is the "nursing orderly"—a cavalry, artillery or infantry soldier doing duty as a hospital orderly. Many of these men, it will be admitted, do their work extremely well considering the amount of training they receive, but it cannot be claimed that they are doing the work of the particular branch of the Service for which they were enlisted. This brings us to the question so often asked by many of us in our own as well as in other branches of the army: "why do the rank and file of the Royal Army Medical Corps not serve in India?" The answer given is usually that the Royal Army Medical Corps men would suffer in health if at continuous hospital duty in India, and that it would be more expensive. With regard to the first-stated objection, it may be pointed out that the health of our men does not appear to suffer in Ceylon, where the climate is very similar to many parts of India, nor in any other colonial stations from this particular cause; nor does it appear to suffer in the case of the regimental orderlies employed in Indian station hospitals under the present system. The second objection will be considered later.

Let us consider what advantages to the Service generally, and to the Royal Army Medical Corps itself, would be gained if service in India for the Corps were in vogue for all ranks. Army Regulations (India), volume ii., para. 890, lays down as follows:—
 "Orderlies required for special nursing duties in hospital will be furnished by the officer commanding the station
 British soldiers may be so employed for any period up to twelve months. . . . The orderlies will be in charge of non-commissioned officers (trained in nursing if possible). . . .
 Soldiers employed in hospitals, and at ambulance and nursing classes, will be excused all regimental duties except the annual

course of musketry, and should not be changed." Now, it will be observed that regimental orderlies are only available for duty in hospitals for twelve months. The consequence is that fresh supplies of men have to be constantly undergoing a short course of nursing duties, this consisting of "training in hospital wards for at least one month . . . those proficient being granted certificates." (Para. 895, vol. ii., Army Regulations, India.) It is true that these men have, in addition, twelve stretcher drills and lectures in first aid before they are selected for the further course of instruction in the wards of hospitals above alluded to, but it is only reasonable to conclude that men so inadequately trained and inexperienced can never be equal to our men either in peace time, or in Bearer Companies (Indian) in which four nursing orderlies are allowed, Field Hospitals (Indian) in which eight are allowed, or in Stationary and General Hospitals in India.

The South African War has shown that we need the most efficient and best trained men for duty in Stationary and General Hospitals, and to a less extent in Field Hospitals, and that such men were obtainable only among the most highly trained of the Royal Army Medical Corps. The same campaign also showed how soon the supply of men of the Corps was exhausted, and how, after the departure from England of the 6th Division, we had to obtain the services of St. John Ambulance men, untrained, specially enlisted men for one year's service, Imperial Hospital Corps, &c.

Now, were our Warrant Officers, Non-Commissioned Officers and men to serve in India, the strength of the Corps would be increased; but what is more important still, an increase in the strength of the reserve of the Corps would result. Thus it is doubtful, with a considerably increased reserve, if we should have to search the highways and byeways to obtain men for service in the field in our next big war. Moreover, the men who have served in India would have had considerable experience in the nursing of such cases as severe malaria, dysentery, enteric fever, &c., all of which diseases are, unhappily, always with us in India, and so prevalent as a rule on active service. Under the present system in India the whole of this valuable experience is wasted on regimental orderlies, who, once they leave the colours, are never likely to be again employed in hospitals in the field should they be called up for active service from the reserve. It may be noted here that the only evidence of a man ever having done duty in hospitals is an entry in his pocket ledger, and the nursing

certificate. In the former the entry is often never made, and the latter need not be produced by the soldier should he prefer to serve with his regiment in the field rather than as a hospital orderly.

To come now to the second objection alluded to in the earlier portion of this paper, namely, increase of cost: The ideal system would appear to be to draft trained men of the Royal Army Medical Corps to India in the same way as to colonial stations. But, considering the vastness of India as a foreign station, a large number of men would be required, and as it is not likely that an increase of foreign drafts for India would ever be sanctioned an alternative plan is suggested. This is, that men who are now taken from regiments and batteries for duty as hospital orderlies may, after a course of stretcher drill and first aid, a probationary period of duty in hospital, and passing an examination on similar lines to that they now pass to obtain a nursing certificate, be allowed to elect for transfer to the Royal Army Medical Corps for the remainder of their service. Commanding officers of regiments and batteries might be authorised to allow the transfer annually of a very small percentage (say 1 per cent. or even less) of men of their unit, of not less than three years' service, to the Corps. The men thus selected would be required to complete eight years' service with the colours in India, as they would have done had they remained in their regiment. They would be clothed and equipped as Royal Army Medical Corps men, and for discipline, pay, rations, &c., be exactly similar to our men serving in other stations abroad. On completion of their colour service they would be sent to the *Dépôt*, Aldershot, for transfer to the reserve of the Corps, or, in the event of their extending their service, would be available for service at home, or in any part of the Empire in which our men serve, which would then also include India.

The establishment of ward orderlies for each Indian station hospital might be the same as laid down in para. 270, Regulations for Army Medical Services, 1900, except that hospitals of less than fifty beds would not be supplied with Royal Army Medical Corps men, but with regimental orderlies as at present. Thus the establishment for a hospital of fifty beds would be five of our men, and a Lance-Corporal or Corporal for their discipline, posting to duty, and to act as librarian and assist in the office. The men would be graded as first, second and third class orderlies and qualify for promotion to the non-commissioned ranks in the usual way. Sergeants, Staff-Sergeants and Sergeants-Major of the Corps could

be employed at Headquarters of Brigades, Divisions and Commands, as chief clerks to Principal Medical Officers. It is not suggested in this article that the permanent hospital establishment provided at present need be altered. The Subordinate Medical Department, Army Hospital Corps and Army Bearer Corps would remain as they are, the only difference being the substitution of Warrant Officers, Non-Commissioned Officers and men of our own Corps for duty in hospitals and offices for those now taken temporarily from regiments for these duties.

In support of my suggestion that Royal Army Medical Corps men for India might be obtained by transfer of men from regiments, if unobtainable from home, I quote from a paper by Lieutenant-Colonel E. M. Wilson, C.B., C.M.G., D.S.O., of our Corps, published in the Corps Journal of January, 1906. He says: "Some of our best men have been transfers of men perhaps originally employed as regimental orderlies or stretcher bearers, men with one or two years' service in a regiment, well disciplined, of good character, who like the work, and who often give up a lance stripe to come to us. These men should be encouraged." Colonel Wilson also refers in that paper to the great importance of a thorough knowledge of military law and interior economy, and we who serve in India know how "rusty" most of us become in these subjects, and how liable we are to lose interest in our men after a five years' tour.

I hope I have succeeded in showing that many advantages would be gained, not only by ourselves, but also by the army generally, if service in India for all ranks of the Royal Army Medical Corps were adopted.

ON THE PREPARATION OF A SATISFACTORY MERCURIAL CREAM FOR INTRAMUSCULAR INJECTION.

By CHARLES ALEXANDER HILL, B.Sc., F.I.C.

By a consensus of opinion, *one* of the most satisfactory methods of administering mercury is by the intramuscular injection of the metal in a state of minute subdivision. The subject has been dealt with from the clinical point of view twice recently : in a general fashion by Lieutenant-Colonel E. Butt, R.A.M.C., in his paper on the Prevention and Treatment of Venereal Diseases in the Army, published in this Journal (vol. vi., No. 1, January, 1906, p. 10) ; and more particularly and fully by Colonel F. J. Lambkin, R.A.M.C., in the *British Medical Journal* (November 11th, 1905, p. 1254). Largely as this method of treating syphilis has been used, one bar to its more general adoption has been the difficulty of preparing a mercurial cream which shall be satisfactory from every point of view. In view of this difficulty, and at the instance of the Army Medical Department, the matter has been submitted by the author to a somewhat extended experimental investigation, upwards of one hundred different creams having been prepared and examined as to their behaviour at various temperatures. The present brief account of the matter is given, in the hope that the chief results arrived at may be usefully recorded. The difficulty attaching to the preparation of a satisfactory cream must at once be apparent, when one considers the not only desirable but essential characteristics of this particular medicament, and the antagonistic nature of some of these. The cream, which must of course be aseptic and remain so, should contain the metallic mercury in a state of extremely fine subdivision ; further, it must retain it in this condition for a reasonable length of time ; *i.e.*, the cream must be "stable." In spite of this the cream must be sufficiently fluid at ordinary temperatures for use in a hypodermic syringe, and yet remain homogeneous at higher temperatures, such as those obtaining at home in summer, and those of tropical climates. Essential, too, is it, that only such substance or substances be used as a "base" to compose the cream as are neutral, non-irritant, physiologically inactive, and not liable to become rancid or acid, nor to separate out at any time (in the tissues of the patient) in hard masses. It will be seen that

44 *Preparation of a Satisfactory Mercurial Cream*

“fluidity” and “stability” are opposing characters, and it is here that the chief difficulty has been encountered. Lambkin’s formula, it may be remembered, is as follows :—

Mercury	5i. by weight,	} 10 minims of cream contain 1 grain of mercury.
Lanoline	..	..	5iv. „
Paraffin liquid	} ad 5x. fluid			
Carbol. 2 per cent.				

The technique of the preparation of the cream has been given by Lambkin, and it may here be stated that for breaking up the globules of mercury as finely as possible (a process known technically as “killing” mercury) and at the same time satisfying the condition of neutrality, &c., previously mentioned, no better substance than lanoline has been found; whilst for diluting this mixture of mercury and lanoline so as to make a product of creamy consistency, the chemically and physiologically inert bodies known as “paraffins” seem to be eminently suited. Lambkin’s cream is, in fact, quite satisfactory for ordinary temperatures (unless a more concentrated cream be desired), but is liable to “separate” in hot weather.

The experiments, the results of which are here recorded, were carried out with the view to preparing creams suitable for use in all climates, and of a greater concentration than 1 grain in 10 minims. No matter how finely divided the mercury particles be, *i.e.*, no matter how carefully the cream may be prepared, there must always be a tendency for the dense mercury particles to fall and aggregate to form larger globules. Two factors determine the rate of this “separation,” viz., (1) temperature, and (2) time. The various creams differ, of course, from one another, in respect to their rate of separation or instability, according to their fluidity. Studying the rate of separation at different temperatures for a large number of creams, has formed the chief observational part of this work. The method adopted was as follows :—

About half an ounce of the cream was placed in an ordinary test tube (about three-quarter inch diameter), and the tube immersed in a vertical position in water, so that the level of the water outside was higher than the level of the mercurial cream inside. The water was then maintained at the desired constant temperature, and in order that this may be easily and effectually controlled it is convenient to have a fairly large mass of water; the baths used in these experiments held about $3\frac{1}{2}$ gallons ($14\frac{1}{2}$ litres). A series of eight such baths were utilised, respectively maintained at the following temperatures: 70°, 75°, 80°, 85°, 90°, 95°, 100°, 105° F. The

tubes were removed from time to time, and carefully examined. The first indication of separation is the appearance of a yellow oily ring at the top. This, later, becomes an oily layer, whilst a change may simultaneously be noticed at the lower extremity, where the light grey mercury globules become visible. If this grey layer be examined microscopically and compared thus with some fresh mercurial cream which has not undergone separation, it is seen that the mercury globules are merely more numerous in the grey deposit than in the unseparated cream, but not larger, *i.e.*, they have not run together. Such incipient or partial separation, therefore, may be remedied by re-mixing the cream until it is once more homogeneous. If, however, the separation has proceeded further, and the mercury globules have aggregated to form larger globules, then no amount of stirring will suffice to break up the globules into the necessary state of fineness and render the cream fit for use.

Mercurial Cream, 1 Grain in 5 Minims.—The cream, which at the time when the experiments were begun was largely used by the Army Medical Department, and which is styled “A form,” was taken as a starting point. It is twice the strength of Lambkin’s cream, the formula being:—

Mercury	2 parts by weight	} 1 grain in 5 minims.	
Lanoline	3 " "		
Paraffin liquid	} ad 10 parts fluid		
Carbol. 2 per cent.			

This cream was tested as to its stability, and it was found that after keeping for two days of nine hours each at 80° to 85° F. there were signs of slight separation. Increasing the quantity of lanoline and correspondingly decreasing the quantity of liquid paraffin in this formula did not serve to produce a cream stable at 85° F., and yet sufficiently fluid for use in a hypodermic syringe at 70° F., the latter condition being incompatible with stability, even at 85° F., and much more so, of course, with stability at higher temperatures. The introduction of “paraffin molle alb” was therefore tried, and a series of creams was prepared, in which first a little, then more and more, and finally the whole of the liquid paraffin was replaced by soft paraffin. The last member of this series, named “B form,” is suitable for use at 85° to 90° F. It differs from “A form” in having paraffin molle in place of paraffin liquid. For higher temperatures still the proportion of lanoline was increased, and another series of creams prepared. The last member was intended for use

46 *Preparation of a Satisfactory Mercurial Cream*

at 105° F., being made entirely with lanoline. It is named "E form."

Mercurial Cream, 1 Grain in 4 Minims.—Experiments were made with the view to the production from mercury, lanoline and liquid paraffin, of a cream which should be of such consistency as to be sufficiently fluid for use in a hypodermic syringe at "ordinary temperatures," and retain the mercury in a state of suspension up to a temperature of 90° F. It was found to be impossible to realise these conditions, the reason being, of course, that when the lanoline is used in sufficient quantity to secure the permanent suspension of the mercury at 90° F., then the cream becomes too viscous for use in a hypodermic syringe at ordinary temperatures. Conversely, when the proportion of lanoline is reduced so as to produce a cream of the required degree of fluidity, then the correspondingly increased proportion of liquid paraffin (carbol. 2 per cent.) causes the cream to "separate" at 90° F. Attempts to produce a satisfactory cream, even when the limiting temperature was reduced from 90° to 75°, were not very successful, though the following is a fairly mobile cream, and on being kept for ten days at 75° F., showed only slight signs of separation.

Mercury	5 parts by weight	} 1 grain in 4 minims.	
Lanoline	8 " "		
Paraffin liquid	} ad 20 parts fluid		
Carbol. 2 per cent.			

Mercurial Cream, 1 Grain in 8 Minims.—Experiments were made in order to produce from the same ingredients three creams of this strength, which should be suitable respectively for use at 75°, 90° and 105° F. For the first two temperatures the following creams were found most suitable.

	" P 2a "			" P 4a "			
Mercury	2	..	2	..	2	..	parts by weight.
Lanoline	7	..	11	..	11	..	" "
Paraffin liquid	} .. 16			} .. 16			,, fluid.
Carbol. 2 per cent.							

The former being stable at 75° F., and the latter at 90° F. For 105°, as with creams of other concentrations, lanoline was used as the sole basis. It has already been stated that lanoline is the best substance for "killing" the mercury. It has, however, the disadvantage of being very stiff, so that in order to prepare a product sufficiently fluid at moderate temperatures a *liquid* paraffin is introduced. Such a mixture of substances differing markedly in physical characters is liable to separate into its component ingre-

dients. The instability of course increases also as the concentration of the mercury increases.

In the series of experiments above mentioned, several creams were prepared in which both soft and liquid paraffins were used; such a cream is the following:—

Mercury	..	..	..	..	2 parts by weight	} 1 grain in 5 minims.
Lanoline	..	..	..	..	3 " "	
Paraffin molle	} p. e.		} ad 10 parts fluid				
..	} liquid						
					carb. 2 per cent.		

Even in such cases, however, at moderately elevated temperatures, the liquid paraffin has a tendency to separate out as an oily layer. It is scarcely necessary to point out that mixing paraffin molle with paraffin liquid does not give a paraffin of intermediate properties, but merely a mixture of the two, which will always behave as a mixture. Being convinced that the instability was chiefly due to the heterogeneous nature of the base, the writer felt that the best solution would probably be found to lie in the use of a *homogeneous* paraffin intermediate in its physical properties between the "soft" and "liquid" paraffins of the British Pharmacopœia. This appeared to be the diluent with which to prepare a cream which should—as far as it is possible to do so—satisfy the requisite but intrinsically incompatible properties of fluidity and stability. The special homogeneous paraffin was obtained as a perfectly neutral white substance, of a consistency which is perhaps best described by the word "sloppy." On heating it to 480° F., in a distillation apparatus, in a vacuum, only a small amount of distillate—a heavy oil—was obtained (absence of "liquid paraffin"); whilst no hard solid separated on cooling to 15° F. for six hours (absence of "solid paraffin"). It will be seen that this last precludes the separation of a solid clot in the tissues of the patient. It liquefies at 73° F.

Several series of creams of various mercurial strengths were prepared with the special paraffin, of which the following are examples:—

Mercurial Cream, 1 Grain in 5 Minims.—The following cream (S. 2), which is fairly mobile, withstood exposure to a temperature of 85° F. for twelve days.

Mercury	2 parts by weight	} 1 grain in 5 minims.
Lanoline	3 " "	
Paraffin special	} to 10 parts fluid	
Carbol. 2 per cent.		

Mercurial Cream, 1 Grain in 4 Minims.—The attempt to produce

48 *Preparation of a Satisfactory Mercurial Cream*

satisfactory creams of this strength was repeated with the special paraffin, and to this end a series of ten creams were prepared and examined at all the eight temperatures previously specified, ranging from 70° to 105° F. The two following were selected as being suitable for 75° and 90° respectively:—

	"T"			"T 3"			
Mercury	5	..	5	..	5	..	parts by weight.
Lanoline	4	..	10	..	10	..	" "
Paraffin special	} .. to 20	..	20	..	20	..	" fluid.
Carbol. 2 per cent.							

Mercurial Cream, 1 Grain in 10 Minims.—Whilst Lambkin's cream ("O" form) separates upon being exposed to a temperature of 80° F., with the special paraffin a cream of the same mercurial strength may be prepared which is available for use at this temperature, and is of a suitable consistency for use in a hypodermic syringe. The following "X 2" is stable at 80° F., being in fact capable of withstanding a temperature of 85° F. for some time.

"X 2"							
Mercury	1	..	1	..	1	..	} parts by weight
Lanoline	3	..	3	..	3	..	
Paraffin special	} .. to 10 parts fluid	..	10	..	10	..	} 1 grain in 10 minims.
Carbol. 2 per cent.							

The effect of Carbolic Acid.—It should be mentioned that the carbolic acid added for the purpose of securing the aseptic condition of the cream has the effect of lowering the melting point of the lanoline and consequently the stability of the cream. This is of course especially true of those creams which contain much lanoline. Thus, experiments made side by side with two samples of cream (1 grain in 10 minims) made entirely with lanoline, the one carbolised to the extent of 2 per cent., the other not carbolised, showed that the one with carbolic acid separated sooner than the other. The proportion of carbolic acid should therefore be the minimum considered sufficient.

Conclusions.—It is only possible to prepare mercurial creams which, as regards mobility and stability, shall be satisfactory for use over limited ranges of temperature. This conclusion favours the use of a dilute cream such as 1 grain in 10 minims; nevertheless it is quite possible to prepare creams as concentrated as 1 grain in 4 minims, which are suitable for any stated temperature up to 105° F. The fact that creams intended for use at summer or tropical temperatures are too viscous for use at ordinary temperatures is not of course a serious drawback, since, in need, they can be warmed before being used.

The most generally useful strength would seem to be 1 grain in 5 minims.

Liquid paraffin should only be used in a cream which is intended for use in cold climates, since the disparity in the physical properties of this substance and lanoline enhances the tendency of the cream to "separate." For the majority of cases a paraffin intermediate in properties between "*paraffinum liquidum*" and "*paraffinum molle*" is most suitable.

For slightly higher temperatures "*paraffinum molle*" may be used. That in the preparation of creams for use at temperatures up to 90° F., it is better to use the same quantity of lanoline for "killing" the mercury and to dilute with a paraffin of suitable consistency, rather than to increase the quantity of lanoline and use liquid paraffin. In the preparation of creams for use at 105° F., the question of the paraffin does not arise, for none can be used, but the base must be only lanoline. Even thus the cream is not indefinitely stable at 105° F., for at this temperature lanoline itself begins to melt.

The experimental work herein recorded was conducted on behalf of, and is published by, the courtesy of the Army Medical Department. The conclusions drawn, however, it should be pointed out, are the author's.

A FURTHER NOTE ON THE SYSTEMATIC TREATMENT OF MALARIA AMONGST EUROPEAN TROOPS.

BY CAPTAIN W. E. HUDLESTON.

Royal Army Medical Corps.

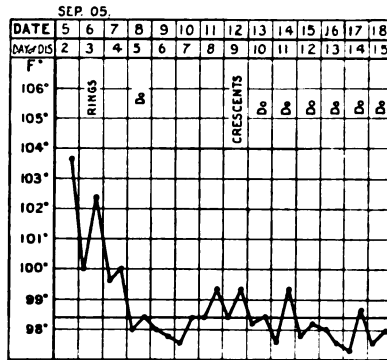
THE following are notes on blood examinations made on 408 individual cases of fever. One hundred and two of these cases were proved by the microscope to be malarial, or 25 per cent. Parasite found: benign tertian fifty-six, malignant tertian forty-six. Temperature charts were kept in the majority of cases, and from a study of the charts of seventy-six of the malarial cases, the following are the striking features: (1) Typical tertian fever is largely seen, even in cases untreated with quinine; (2) in benign tertian infection the fever generally ceases within two or three days of the patient's admission to hospital, irrespective of the administration of quinine; the slightest exposure, however, either to heat or cold causes a return of the fever; (3) in benign tertian infection the administration of quinine sulphate, 15 grains twice in twenty-four hours, not only stops the fever, but in the majority of cases causes the disappearance of the parasite from the peripheral blood; (4) in malignant tertian infection high fever of an intermittent character is the rule during the ring-stage of the parasite, whereas the temperature is normal, or only very slightly raised, during the crescent-stage. This "crescent-forming interval," described by Buchanan in his "Malarial Fevers and Malarial Parasites in India," will be well seen in the appended chart; (5) this crescent-forming interval frequently lasts ten or fifteen days, meantime the patient feeling perfectly well; (6) the administration of quinine sulphate, 15 grains twice daily, appears to have little or no effect on the crescents which persist and can be found daily in the peripheral blood; (7) both in benign and malignant tertian infection the parasite is just as easily and as often found in the apyrexial as in the pyrexial stage.

The Effect of Quinine given in known Cases of Malaria.—Dose: quinine sulphate, 15 grains twice daily for four days, and then daily during the stay in hospital. On leaving hospital the patient attends once a week and gets quinine sulphate, 15 grains, continuing, if possible, to attend, for two months. All my benign tertian, and most of my malignant tertian cases, were treated as above; however, for the last three months I have given the latter cases 15

grains of quinine sulphate twice daily during their whole stay in hospital.

Out of the 100 cases thus treated, seventeen were re-admitted whilst undergoing the course of treatment; fifteen being re-admitted once, one twice, and one three times. From enquiries made at "quinine parades," about another twelve or fifteen had slight fever in barracks whilst undergoing the treatment. This gives us roughly 60 per cent. of known cases of malaria kept free from fever by the above dosage of quinine. These cases cannot be described as cures, as many get fever again within three weeks of leaving off their quinine.

Corps, The Royal Scots. Private P. Disease, Ague, M.T.



Examination of blood on September 19th, 22nd, and 24th, negative.

Quinine as a Prophylactic.—Dose: quinine sulphate, 15 grains (in tabloid) once a week. Two companies of the Royal Scots received the above dose from September 1st to November 4th. The remainder of the companies from October 15th to November 30th.

Method.—The men were paraded by companies. Each company provided a nominal roll from which the N.C.O. called out the names, and on which was noted the date on which each man received his dose. The absentees paraded on the following day. A Medical Officer was invariably present at these parades, also an Assistant Surgeon and two ward servants, one ward servant washing glasses and the other giving fresh drinking water to each man. I may remark here that the men never evinced any dislike for this compulsory issue of quinine; on the contrary, many of them when ordered away for duty asked for quinine tabloids to take with them. From the nominal rolls thus kept I have col-

lected the names of 500 men who, between September 1st and November 15th, took their quinine for three or more consecutive weeks. The following is a comparison of these 500 men with that for the same period of 154 men of the 62nd Battery, Royal Field Artillery, who did not take quinine regularly.

PROPHYLACTIC EFFECT OF QUININE.

Five hundred men of the Royal Scots took 15 grains of quinine sulphate once a week, from September 1st to November 15th, and seventeen men were admitted to hospital for malaria during that time	34 per 1,000 strength.
One hundred and fifty-four men of the 62nd Battery, Royal Field Artillery, did not take quinine regularly during that period and twenty men were admitted for malaria	129.8 „ „

Malignant Tertian Fever.—The high percentage of the above cases was unexpected by me, but I believe that more frequent and more careful examination of blood films from malarial cases will show that malignant is almost as common as benign tertian infection. In August and September, 1905, I began to find frequently persistent ring-forms in the blood. A man would come with irregular fever, and on examining his blood for three or four consecutive days nothing but rings would be found—no rosettes, no gametes. These rings were small, very thin, and often had two chromatin dots. The containing corpuscle was generally small, and often crenated. I decided to watch one such case, giving no quinine. The results will be seen in Chart, Private P.; crescents appeared on the ninth day. Since then I have seen these persistent ring-forms so often that I can confidently diagnose them as malignant tertian, and as confidently prophecy the appearance later of crescents. A study of this chart will show that high and irregular fever occurs in the ring-stage, and a practically normal temperature characterises the crescent-stage; that the crescents are extremely resistant to the action of quinine; that a man with a normal temperature and feeling perfectly well may have his blood full of crescents and be a source of infection to everyone in his barrack room. The name, malignant tertian, scarcely prepares us for such mild cases, but I have seen some severe cases during the year 1905, notably that of Trumpeter MacD., described in my first paper,¹ and another lately, in which on admission the patient had vomiting, purging, and severe cramps in the calf muscles—

¹ JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. v., p. 635.

the choleraic type of some writers. His blood contained crescents. One pauses to think how many of these mild cases of malignant tertian infection one has returned to barracks in the crescent-stage, and how many fresh cases have been infected through them.

General Remarks.—I have demonstrated that here in Kamptee 25 per cent. of all cases of pyrexia are of malarial origin. If this is the usual percentage in India, and there is every probability that it is so, it is obviously most important to work out some systematic treatment. How often do we find some such entry as this in a Medical History Sheet: "Ague, mild, climatic; quinine; recovered"? Can we cure ague by giving quinine? If so, what is the average amount required and for how long should it be continued? Short of cure, can we keep the infected person (a) free from fever? (b) incapable of infecting others? Can we by systematic dosing with quinine immunise the community?

Method of Examination.—Leishman's stain was used in every case. The results were uniform and excellent, and the saving of time enormous. Other advantages in using this stain are the ease with which the parasite can be seen, owing to the brilliant chromatin staining, and also the plain way in which Schaffner's dots show up, enabling one to at once differentiate the benign tertian parasite. I have been told by others that Leishman's stain purchased in India gives unsatisfactory results. I can only say that Leishman's stain, obtained from Messrs. Ball and Hobson, of Umballa, has given me beautiful results.

Note.—On finding large and small red-staining granules in the large mononuclear leucocytes, I thought I had found a new parasite. The only book which describes these as a normal phenomenon in Leishman's staining is Daniels' "Laboratory Studies in Tropical Medicine."

THE PRESERVATION OF HEALTH AMONGST THE PERSONNEL OF THE JAPANESE ARMY.¹

BY BARON TAKAKI, F.R.C.S.ENG., D.C.L.

*Late Director-General of the Medical Department of the Imperial
Japanese Navy.*

ON the subject of Army Sanitation I am afraid I cannot quite claim the same knowledge, and speak with the same authority, as in the case of the Navy, owing to the fact that my duty was chiefly concerned with the Navy. As to the practical experiences which I acquired during my short stay in Manchuria, I can claim only very little. But your Army had a most capable man at the front as your Military Attaché, and Lieutenant-Colonel W. G. Macpherson, C.M.G., R.A.M.C., the late British Medical Attaché to the Japanese Army, has already described and published articles concerning our medical organisation for the preservation of the health of the Army, under the title of "The Medical Organisation of the Japanese Army," in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, March, 1906. If any of you are interested in the subject of our medical organisation I strongly recommend you to read his clear and excellent article in that Journal. The facts are very clearly and correctly described, and I think you may rely on them without fear. The time at my disposal being short, I will omit the subject of our medical organisation, and will proceed to explain various figures, which I obtained from our military authority in Tokio, showing the results of our efforts in preserving the health of the Army. The struggle against beri-beri, which has been going on in the Navy, has also been taking place in the Army, and the percentage of beri-beri cases was a good indication of the general health of the Army, because, whenever beri-beri cases diminished, the health of the Army also improved greatly, that is to say, cases of other diseases decreased proportionally.

MILITARY HYGIENE.

The health of our Army has been gradually improving of late years, but beri-beri is not yet eradicated from it as it is from the Navy, and I regret to state that, although the cases are few in time of peace, the disease is apt to break out in time of war, just when

¹ A lecture delivered at St. Thomas's Hospital, May 11th, 1906

strong men are needed. In former years, beri-beri prevailed as largely in the Army as it did in the Navy. The following table explains these facts :—

		BERI-BERI PER 1,000 OF MEN.			
Date :		1883	1884	1885	1903
Name of Division, &c.					
Imperial Guards	489·53	486·56	269·82	14·63
Gendarmes	.. ..	408·17	354·54	254·96
Academy, &c.	.. ..	607·70	725·00	412·12
School of Sergeants, &c.	.. ..	217·82	412·89	349·81
Tokyo Division	.. ..	349·38	467·99	311·16
Sendai Division	.. ..	120·16	216·02	138·36
Nagoya Division	.. ..	119·55	100·24	94·58
Osaka Division	.. ..	308·31	232·90	7·07
Hiroshima Division	144·82	2·85	3·08	
Kumamoto Division	102·95	154·75	39·17	

This table shows that a great number of cases used to occur every year. The various sections of the Army suffered differently as to numbers, so that the hospitals provided for certain divisions were inadequate to take in all the cases. In order to meet such emergencies, other accommodation was provided in special localities to which patients could be sent, change of air being considered beneficial and curative. In the Osaka division the number of cases greatly diminished in 1885. This result is considered to have been due to a supply of barley with the rice, in proportion of 3 to 7. The Hiroshima division has suffered very little in general. The price of food there is less than at other places, so that better and more nutritious food could be had at the same expense, the division being supplied with some bread in place of rice. The results of the experimental use of barley in the Osaka division, and in the Navy, induced the Army authorities of other divisions to adopt a supply of barley in proportion of 3 of barley to 7 of rice, and the result in 1903, as shown by this table, was a decrease of beri-beri.

Unfortunately, during the Chino-Japanese and at the beginning of the Russo-Japanese War, only rice was given to the men as their principal food, and, in consequence, the cases of beri-beri increased greatly, but in the later period of the Russo-Japanese War, when we began to give the men barley with rice, and increased the quantity of meat, the cases decreased rapidly. Another illustration of the influence of diet upon the health of the men is shown by the fact that there was not one case of beri-beri among the sailors of the Naval Brigade during the siege of Port Arthur, although there was a large number amongst the soldiers of the

besieging Army. These sailors lived among the soldiers, and under exactly the same conditions, but they were supplied with one pound of meat, ten ounces of barley, and twenty ounces of rice per day, while the soldiers were supplied with five ounces of meat and thirty ounces of rice per day. The above examples confirm my view that beri-beri chiefly occurs among men who are fed with an insufficient quantity of nitrogenous food and an excess of carbohydrates. The following tables show the state of our Army's health during the recent war:—

TABLE I.
NUMBER OF CASUALTIES IN THE RUSSO-JAPANESE WAR, 1904—1905.

	Killed	Wounded	Missing	Casualties	Total Casualties
Officers	1,657	5,307	53	7,017	201,973
N.C.O.'s and men ..	41,562	148,366	5,028	194,956	

Warrant Officers are included under Officers. The table was made from the reports received up to June 30th, 1905, concerning troops in Manchuria, and to the end of August, 1905, concerning troops in Corea and Saghalin. The proportion of officers killed to officers wounded is as 1 to 3·25, and that of Non-Commissioned Officers and men as 1 to 3·56. The table shows that the Officers killed were in a larger proportion than the Non-Commissioned Officers and men. The proportion of deaths from wounds, including both killed and subsequent deaths, is as 1 to 3·94.

TABLE II.
NUMBER OF PATIENTS ADMITTED INTO THE FIELD HOSPITALS FROM THE BEGINNING OF THE WAR TO AUGUST 31st, 1905.

	Wounded	Accidents.	Infectious or contagious diseases	All diseases	Total
Cases	146,813	16,456	17,866	203,270	384,405
Recovered	15,018	4,147	2,044	23,063	44,272
Died	8,304	237	5,961	6,850	21,352

The above table may have to be corrected later. The proportion of deaths from infectious and all diseases (the total number is 12,811) to that of deaths from wounds is as 1 to 4.

TABLE III.
SHOWING THE FINAL DISPOSAL OF THE PATIENTS EVACUATED TO JAPAN.

Classification	Officers			Warrant Officers			N.C.O's and men			Non-Combatants		
	Wounded	Infectious or contagious diseases	Miscellaneous	Wounded	Infectious or contagious diseases	Miscellaneous	Wounded	Infectious or contagious diseases	Miscellaneous	Wounded	Infectious or contagious diseases	Miscellaneous
Cured ..	1,097	..	930	287	1	227	50,690	460	73,327	64	50	10,477
Invalided ..	3	..	10	2	..	1	11,355	..	4,113	..	..	..
Died..	26	1	18	3	..	3	935	311	2,125	1	40	138
Miscellaneous	1,089	9	801	346	3	167	36,941	1,095	57,207	51	133	1,072
Remaining ..	137	1	178	27	..	51	9,604	42	14,790	3	10	1,095
Totals ..	2,352	11	1,937	665	4	449	109,525	1,908	151,562	119	233	12,782
Grand total..	..	281,547										

This table is compiled from the reports received from the beginning of the war to the end of August, 1905. The miscellaneous include those cases sent to their own homes and discharged from hospital from other causes. This table may have to be corrected later. The proportion of the wounded to cases of infectious and other diseases and accidents is as 100 to 150.

TABLE IV.
TABLE OF INFECTIOUS AND BERI-BERI PATIENTS FROM THE BEGINNING OF THE WAR IN 1904 TO THE LAST DAY OF AUGUST, 1905.

	Small-pox	Scarlet fever	Typhus	Diphtheria	Typhoid	Dysentery	Beri-beri
Cases ..	347	10	51	9	9,722	7,642	97,572
Deaths ..	33	2	11	1	4,073	1,804	3,956

This table may also have to be corrected afterwards.

TABLE V.
COMPARATIVE TABLE OF INFECTIOUS DISEASES PER 1,000 OF MEN.

	CHOLERA		TYPHOID		DYSENTERY		MALARIA	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Japan-China War ..	82.77	50.86	37.14	10.98	108.96	15.72	102.58	5.29
North China trouble ..	..	..	36.42	12.14	108.71	33.65	95.61	2.20
Russo-Japan War ..	..	..	9.26	5.16	10.52	2.68	1.96	0.07

This table is compiled from the reports received from the beginning of the war to the last day of May, 1905, and also may have to be corrected later.

The preceding table is of great interest as showing the progress that has been made in our Army in the preservation of health since the Chino-Japanese War. Comparing the result of the Chino-Japanese War with that of the recent war against Russia, we find the following facts :—

(1) That cholera has practically disappeared.

(2) That typhoid fever cases decreased from 37·14 per 1,000 of men to 9·26 per 1,000.

(3) That dysentery cases decreased from 108·96 per 1,000 of men to 10·52 per 1,000. The death rate was brought down from 15·72 per 1,000 to 2·68 per 1,000.

(4) That malaria cases decreased from 102·58 per 1,000 of men to 1·96 per 1,000. The death rate is practically *nil*.

These remarkably good results were chiefly the result of the progress made in the medical organisation as regards food, drink, clothing, camping ground, &c., and we took great pains to exterminate flies and to prevent them from coming in contact with our body, articles of daily use, and into the dwelling houses. Nets were used at windows and doors of houses to prevent flies from coming in, also to protect the exposed parts of the body, such as the face, when flies were numerous. This extensive use of muslin nets against flies, and at the same time against mosquitoes, may possibly be responsible, besides the improved sanitary organisation, for the remarkable decrease in the number of typhoid, dysentery, and malaria cases. I may mention that another prophylactic, which we did not employ previously, was the use of creosote pills. Each man in health was supposed to take one of these daily throughout the campaign, and this, too, may have had some influence in causing these improved health conditions.

GENERAL REMARKS.

During the recent war we had to take the strictest precautions to keep our men from any epidemic disease, by carrying out the various plans arranged at the beginning of the war. For instance, for the water supply, we had to provide a water cart drawn by four horses, and a water boiler cart drawn by one horse; boiled water-stations were established, a small mess-tin being carried by

each soldier, so that he could have boiled water by boiling it in his own mess-tin when required. At the boiling water-station during the march the soldiers had to fill their own water-bottles with boiled water. During the march, when they had exhausted their water-bottles, they had to get water from the water boiler

TABLE VI.

TABLE OF THE MEDICAL OFFICERS OF THE ARMY OF JAPAN, NOVEMBER 10TH, 1905.

Ranks	Active	Reserved	Retired	Total
Surgeon-Lieut.-General ..	1	3	..	4
Surgeon-Major-General ..	7	2	2	11
Surgeon-Colonel ..	37	5	3	45
Surgeon-Lieut.-Colonel ..	43	6	5	54
Surgeon-Major ..	176	29	19	224
Surgeon-Captain ..	443	78	74	595
Surgeon-Lieutenant ..	232	866	110	1,208
Surgeon-2nd Lieutenant ..	234	2,076	6	2,316
Probational Surgeons ..	38	..	..	38
Pharmacists—				
1st Class Inspector ..	1	..	..	1
2nd Class Inspector ..	2	..	..	2
3rd Class Inspector ..	8	4	1	13
1st Class Pharmacists ..	53	7	5	65
2nd Class Pharmacists ..	30	72	9	111
3rd Class Pharmacists ..	16	428	2	446
Total ..	1,321	3,576	236	5,133

TABLE VII.

TABLE SHOWING CASUALTIES AMONG THE MEDICAL OFFICERS DURING THE WAR.

Ranks	Killed or died from wounds	Wounded
Surgeon-Colonel	1	69
Surgeon-Captain	2	
Surgeon-Lieutenant	6	
Surgeon 2nd-Lieutenant	9	
Total ..	18	69

cart, which always accompanied the troops, when possible, the water carts being almost always with them. When they had to get water from a stream or river, they were ordered to get the drinking water from the centre of the stream, so as to avoid impurities coming from the banks of the river; even then the water had to be boiled before they drank it. As a result of

experience, they found some difficulty in telling whether water which they got during the night was pure or dirty. They could, of course, see the water, but the light was not sufficient to enable them to say whether it was pure or not. We had, therefore, to take great care during the night marches.

Food.—Almost all foods were sent from Japan to the front under strict superintendence of officials, who ranked as officers, but, of course, whenever possible, fresh food was obtained locally. Strict precautions were taken not to get any injurious materials from the natives, because there was some danger of poisonous matter being mixed with it. We always tried our best to give fresh food as much as possible. During the severe winter the soldiers had to keep their mess-tins wrapped in pieces of flannel under their overcoats to prevent them freezing. They also were ordered to cook their rice each time they had to eat it, when possible; and at times they were given biscuit in place of rice and barley. During the hottest part of the summer, a small quantity of acetic acid was added to the cooked rice and barley, in order to prevent decomposition. Besides a regular supply of food materials, the soldiers were allowed to buy some eatables locally, special regulations being laid down prohibiting them from buying food directly from the natives. *Saké* (two ounces on an average) was allowed to each man, as an extra, under the strict superintendence of the medical officers. Sweets were allowed to those who had no inclination to drink *Saké*.

Camping.—Whenever they had to go into camp, first of all a so-called camping party, consisting of line and medical officers, was sent on to select a place where they could be safe both from a strategical and sanitary point of view. The medical officers had to inspect the source of the water supply, the condition of the houses found there, and the people living therein. When medical officers found any water which was unfit for drinking purposes, they put up a notice cautioning the troops not to take it, and where there was any liability of the soldiers using it, a guard was placed over it.

The Chinese inhabitants were inspected as to whether they were suffering from any infectious disease or not. On finding any suffering from such, a special quarter was provided to which they were sent, where they were treated by the medical officers. The houses which were used as quarters by the soldiers, and which had been occupied by Chinese, were first cleansed from corner to corner, and the parts which they considered dangerous disinfected;

they also thoroughly cleansed and disinfected, as much as possible, the surface of the soil round the houses, as well as that outside the camping ground. Afterwards they removed daily and destroyed all the combustible refuse by burying or burning it. Fæcal matter was treated in the same way as is done in other countries.

As to flies, we had considerable trouble with them. At the beginning we tried to kill them in various ways, but they were so numerous that we were practically overwhelmed by them. On discovering that they laid their eggs in manure, as well as in refuse, we tried to burn all the manure and refuse as quickly as possible. We were thus able to diminish the number of them considerably.

Clothes.—Besides washing the clothing as often as opportunities occurred, we had disinfecting apparatus with which the clothing, &c., belonging to each soldier was disinfected or sterilised whenever we thought it necessary to do so. Each apparatus had a capacity of disinfecting for twenty men at a time. I believe we had to use more than one hundred disinfectors, and I still further believe they were a very useful means of preventing any epidemic disease from spreading.

Sending the Troops to the Front.—Before the troops were sent out to the field they were made to undergo strict inspection by medical officers to see whether there was a suspicion of any form of epidemic disease amongst them. When such was found all were disinfected before being sent out. In the transportation of troops from the front back to Japan, all had to be disinfected at quarantine stations, after which they were allowed to land. We are now employing three quarantine stations, the principal of which is that of Ninoshima, where they can disinfect 6,000 men in the course of twenty-four hours. The means of disinfection employed there are both steam sterilisation and formalin fumigation, a description of which is unnecessary here, as they are the same as you have in your own quarantine stations.

All the transport ships underwent a thorough cleansing and disinfection each time they came back to port, the space between decks being cleansed and disinfected with steam, &c.

As to the treatment of wounds, our Army surgeons were in favour of conservative surgery, and all were treated aseptically as much as possible. In a great many cases, with the first dressings applied, they healed in a week or ten days without the dressings having been changed. Major operations were avoided as much as possible at the front, but, of course, after the evacuation to Japan,

they were performed according to the nature of the wounds. Various means of treating the wounded at the front were employed, but, on the whole, aseptic surgery was the principal object. As to the results and termination of all the cases treated, we are not yet in a position to inform you, because such a large number of troops and medical officers were employed, consequently the reports, which were made at the front, had not arrived at the time I obtained the notes which I have given you here. As one part of the results and terminations of treatment, I give you a short account of the hospital established in Hiroshima.

The hospital was established in April, 1904, and the report covers the period to November 30th, 1905, during which time the hospital admitted 203,782 cases, of which 162,885 were transferred to other hospitals. The average number of patients in the hospital was about 5,000, and the largest number the hospital had was 10,000 cases at a time. Almost all the serious cases were kept in the hospital because they were unfit to be transferred, yet the result was so good that the ratio of deaths and invaliding is a little above 1 per cent. Almost all the wounds of the soft tissues healed within about ten days; those with injuries to the bones progressed favourably, except those who were wounded at the siege of Port Arthur. Many men who were wounded in the head and chest have recovered. There were many cases of traumatic aneurysm and wounds of nerves requiring operation. The number of operations performed at the hospital amounted to more than 3,500.

MEMORANDUM REGARDING ANTITYPHOID INOCULATION.

BY CAPTAIN W. S. HARRISON.
Royal Army Medical Corps.

THE vaccine which is used now is one modified according to the results of experiments made during the last year and a half, which aimed at finding out the cause of some of the irregular results recorded in the past, and at obtaining a more effective vaccine. This vaccine was used for the 17th Lancers. The results of the epidemic at Meerut among this regiment have all the force of a laboratory experiment, since the men who formed the test were all under the same conditions throughout. The statistics of this outbreak are already known, and they demonstrate conclusively that the vaccine as at present prepared does give a very large measure of protection against typhoid fever to those inoculated with it. The dose which is recommended at present is a quantity containing 500 million bacteria for the first dose and 1,000 million for the second dose; these are generally contained in 1 cc. and 2 cc. of fluid respectively (18 and 36 minims). It is absolutely essential that both doses be given, the second after an interval of ten clear days. (The only case among the inoculated in the Meerut epidemic occurred in a man who had refused the second dose.)

The clinical effects of the inoculation are much milder than was the case with the old vaccine. The site of inoculation becomes tender about three hours after the dose (which is best given about 4 p.m.); about seven hours after inoculation, the temperature will be found to be 100° to 101° F., but the corresponding malaise is not more marked than one gets with a moderately severe cold. The whole of the following day there is tenderness at the site of inoculation and some pain on walking, the local symptoms being much aggravated if the subject takes the very smallest quantities of alcohol. The day after, *i.e.*, about thirty hours after inoculation, all symptoms have disappeared as a rule, except, perhaps, some tenderness on pressure over the site of puncture. Appetite is slightly impaired during the early part of the reaction, but there is no vomiting or diarrhoea, and headache, if present, is not severe. After the second dose the local reaction comes on more quickly and disappears more quickly also; as a rule there is but little general reaction with the second dose. In malarial subjects, at times, the inoculation has seemed to

induce an attack of ague, and it might be a useful thing in such cases to give a preliminary dose of quinine the day before to obviate this accident.

With regard to reducing the dose, the results of the observations made at Aldershot on inoculated men of the Royal Fusiliers, which were published in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS (Leishman, Harrison, Smallman and Tulloch), showed that the dose which we recommend at present cannot be reduced without a corresponding reduction in the amount of protection afforded, and apart from this, the local symptoms which are chiefly complained of, are not appreciably less with even a quarter of the present dose.

As regards the duration of protection, I have found evidences of an increased quantity of protective substances in the blood up to six years after inoculation, but whether they would be in sufficient quantity at that period to actually protect a man against infection is not known as yet, so that for the present we recommend re-inoculation from time to time—say once in two years.

A sufficient quantity of antiseptic is added to the vaccine to prevent the growth of contaminating organisms, so that with reasonable care in use, a bottle need not be thrown away after taking out a dose or two. Any attempt, however, to sterilise a bottle of vaccine by boiling, as is done with fluids for ordinary hypodermic injection, would at once destroy its efficacy as a vaccine. I mention this because I have heard of a case where it was done. We do not know as yet how long after preparation a vaccine remains efficacious. It is effective for a year certainly, so that it would be desirable to get at one time no more than would suffice for a year's consumption, and it is also to be desired that some arrangements be made for preventing waste; on our part we are at present putting up the vaccine in bottles of various sizes with this end in view.

As regards *syringes*, the most convenient form is one holding 5 cc.; the Roux pattern syringe is, I think, the best for the purpose; the all-glass syringes are good, but the absence of the little wheel on the piston rod for regulating the dose is a great drawback, especially when one is inoculating a large number of men. In the matter of the usual explanatory lecture to the men, Colonel Leishman is at present revising his pamphlet containing suggestions and facts for these lectures. It is found that the number of volunteers depends very largely indeed on the officer

who gives the lecture: if he is personally prejudiced against inoculation there are no volunteers, and if he is half-hearted about it, there are very few indeed, which is what one would expect. On the other hand, under favourable circumstances, as many as 50 per cent. or more of the men have volunteered. So far we have sent no vaccine to India, except that supplied to Lieutenant Smallman and Lieutenant Luxmoore, and some which was put on board transports for use during the voyage.

We have already prepared a fair quantity of vaccine for India and will be able to supply an instalment, at any rate, of that required at once.

DOSAGE OF METALLIC MERCURY IN INTRAMUSCULAR TREATMENT OF SYPHILIS.

BY BREVET-COLONEL F. J. LAMBKIN.

Royal Army Medical Corps.

IN the "Final Report of the Advisory Board for Army Medical Services in the Treatment of Venereal Disease in the Army," reference is made to the standardised mercurial cream as suggested by me for use in intramuscular treatment of syphilis. In this Report the dose of the cream is laid down as mxxv . (gr. $1\frac{1}{2}$ of mercury) per week.

With regard to the composition of this cream, I may say that I arrived at it as the result of experiments with various other preparations made by myself and the chemical examiner, Bombay, in 1903, and as to its dose, twenty years' experience of treating syphilis by intramuscular injections of mercury (metallic), taught me that for a long time I had been giving quite unconsciously large doses of the metal out of all proportion of what was actually required, and that with very much reduced doses I obtained as good, if not better, results, and, of course, with far less risk to the patient of salivation, &c. Hence, during later years, I have been gradually reducing the dose until I arrived at what I consider to be the maximum which is required, under most circumstances, to bring about the necessary reaction, viz., mx . of the cream (gr. 1 of mercury) per week. I consider that this dose should seldom, or never, be exceeded, and I may add that, if anything, my tendency is to reduce this even lower. As it is outside patients, who are attending hospital for continuous treatment, receive only miv . (gr. $\frac{1}{2}$) per week.

Clinical and other Notes.

A SUGGESTION FOR THE PROBABLE REDUCTION, AMONG PHYSICALLY SELECTED CLASSES, OF THE RATE OF INVALIDING FOR TUBERCULOSIS.

BY LIEUTENANT W. C. RIVERS.

Royal Army Medical Corps (H.P.).

IN the *British Medical Journal*, April 29th, 1905, and June 16th, 1906, endeavour has been made to show habitual or abnormally frequent mouth-breathing in the light of a predisposing cause of consumption, possibly of other forms of tuberculosis as well. One piece of evidence put forward was the fact that various causes of this condition were found present about twice as often amongst some male consumptives as in a comparable series of non-tuberculous men. Now, of each set of cases rather less than a sixth came from three physically selected classes, naval seamen, soldiers (who formed the majority), and police-constables. They were met with at a number of places—several public sanatoriums, a dental hospital, and the tubercle and minor venereal wards of Netley and Woolwich—and, as already indicated, the result of examination went to show a great discrepancy in the occurrence of mouth-breathing. While of the first lot nearly three-parts (72·5 per cent.) suffered from some impairment, quantitative or qualitative, of nasal respiration, the proportion of the “control” cases so affected was only one quarter (25·6 per cent.).

To give a few details, four-fifths of the former series had to leave their service on account of pulmonary tubercle, and one case because of wounds, the remainder becoming phthisical after retiring healthy and whilst carrying on civil occupations. Two cases (a sailor and a soldier) were invalided within five months and nine months respectively of the date of enlistment. Rather more than half the soldiers fell ill at tropical or sub-tropical stations; one or two dated their nasal obstruction from injury to the nose (as in boxing) received while with the colours.

A further result upon which one based the conclusion above stated, was the finding of an association—closely similar in phthisical and in healthy cases—of a family history of phthisis with mouth-breathing on the one hand and with a poor physique¹ on the other; these two conditions, when antecedent to the disease under notice, seeming to tend toward an alternative incidence. Thus, amongst men whose general physical development approached, say, that of a Guardsman or a Garrison

¹ The index chosen was, for want of a better, the relation to anthropometrical standard of each case's healthy height-weight ratio.

Artilleryman, the mouth-breathers, whether consumptive or not, gave a "parent-brother-sister" history of consumption about thrice as often as the remainder did; and conversely in the case of the weedy, the excess was on the side of the non-mouth-breathers. On this, as well as on other scores, pulmonary phthisis was considered to be essentially a physically selective disease, inasmuch as the well-set-up man seemed scarcely ever to have it if he were neither alcoholic nor a mouth-breather. Now, of course, the classes under notice are very free from those of poor physique. Four only of the phthisical and two of the control cases failed indeed to give a reasonably good height-weight ratio. Every effort, too, is made by their authorities to prevent alcoholism, while unhealthy climates are unavoidable. But as regards mouth-breathing, it is submitted that the medical advisers of these same authorities are in a position (theoretically, at least) to make quite easily a possibly invaluable experiment in the prophylaxis of tuberculosis. There may be practical obstacles not apparent to one of short experience, but it is hard to conceive of such. Faulty nasal respiration is known to be unhealthy, and to predispose to other disease, so that its rectification is desirable on general grounds. So well is this known, that in the case of the Army, at least, all that seems required is the laying of additional stress on, and perhaps a slight expansion of, an existing provision: Paragraph 521, to wit, of the Regulations for Army Medical Services, 1900. The recruit with a deviated nasal septum would then be sent for appropriate treatment just as unfailingly as are now those suffering from varix or bad teeth, and equally rejected if his defect were not put thoroughly right: a point of some importance, this latter, for a slight and unobtrusive degree of nasal obstruction seems common in phthisis. To speak anticipatorily, it should not be hard, with the help of the existing complete sickness statistics, to find the exact percentage of rejections necessary to secure an optimum balance of advantage. This possibility of exact measurement of any resultant benefit (which the demographer lacks), is of course important for another reason: in the best event, civil action might be guided by naval and military results. It is easy to run to conjecture overmuch, perhaps. In the services, unlike the general community, the great problems of prophylaxis are, of course, those of venereal disease and of paludism. Yet, if in a year nearly 800 men can be totally lost through tubercle to the Army alone—doubtless most of them from consumption—there seems little question as to whether or no it be worth while to take some such course as that just indicated, especially as many of these cases are sent home from Asiatic stations at great expense.

It is suggested, then, that detailed action might prove profitable.

ERYTHEMA NODOSUM (NODAL FEVER).

BY MAJOR C. W. R. HEALEY.

Royal Army Medical Corps.

HAVING read a book, recently published by Dr. Alfred Austin Lendon, of Adelaide, Australia, in which the author (who has collected notes of sixty-three cases), maintains that erythema nodosum is an acute specific fever, and that its course is marked by a prodromal stage, a stage of eruption, and by a period of convalescence, I was much struck with his description of the disease, more especially as I had a case under treatment in the Royal Infirmary, Dublin, at the time. The description of the disease in our ordinary text-books on medicine is extremely brief in some cases, and in others it is not dealt with at all; whilst in books devoted especially to diseases of the skin, it is classed amongst the *Erythema multiformi*, and described chiefly with reference to the local manifestations in the skin, whereas it will be seen by the description of the case which follows, that it is more like a specific fever. It is preceded by a prodromal stage, which lasts from four to twelve days, in which the symptoms are chiefly those of general malaise with headache, furred tongue, shivering fits, constipation, vague abdominal pains, and the occurrence of conjunctival phlyctenulæ. Exacerbation of these symptoms, with a rise of temperature, usually occurs on the third or fourth day before the rash makes its appearance. The rash is first seen on the legs, the individual nodes varying in size from a threepenny piece to those with an area of three inches or more. They are at first bright red, oval in shape, raised, hard, painful and tender to pressure; their distribution being, as a rule, in the long axis of the limb. About the third day they fade and become of a dull purplish colour; about the tenth day they have the appearance of a bruise; the skin then becomes crinkled with a form of branny desquamation, and finally there is a colourless thickening of the skin left where the nodes previously existed. The nodes never suppurate, and they do not all come out at once, but in crops, so that all stages of the eruption may be seen at the same time in the one patient. A copious rash may be taken generally as an index to the severity of the attack. The pain referable to the nodes is of a dull, aching character, and is much increased by placing the limb in a dependent position. The temperature rises on the third or fourth day before the appearance of the eruption, and persists until the rash commences to fade. After the disappearance of the rash, the state of convalescence begins, and the chief feature of this stage is the marked debility of the patient, which persists for a considerable time after the temperature has become normal and the marks of erythema nodosum have disappeared. During the convalescent stage, after all signs of the eruption have disappeared, the patient complains of a heavy, dull, aching pain in the legs, most marked when they are put to the ground. One attack does not protect against subsequent ones.

Four types of the disease have been described: (1) With rheumatic complications; (2) with gastro and abdominal symptoms; (3) with sore throat (enlarged tonsils, with general congestion); (4) relapsing type.

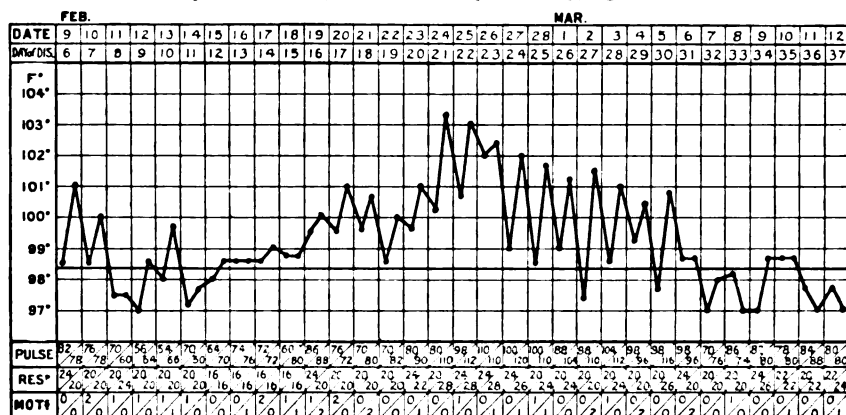
These different types may be combined with one another. Having briefly reviewed the various stages of the disease, I will describe the case which came under my care:—

Private J. Q., Royal Irish Rifles, aged $19\frac{6}{12}$ years, a rather weakly-looking man, was admitted into the Royal Infirmary, Dublin, on February 9th, 1906, suffering from abdominal pain, chiefly referable to the sigmoid flexure and descending colon; the pain was severe and was increased by any pressure. Temperature on admission 98.6° F. in the morning, 101° F. in the evening; tongue was much furred, tonsils enlarged, throat congested, bowels constipated, urine high coloured, acid, and free from albumen. Patient stated that he had been feeling ill for about a fortnight prior to his coming to hospital, during which time he had been suffering from headache, constipation and shivering fits, which were followed by sweating. A somewhat faded erythema nodosum rash was seen on his legs, and he stated that it had existed for a week prior to his admission to hospital. The symptom which caused the most distress was the abdominal pain. Patient did not complain of his legs being painful until the question was asked. The abdominal pain, which I believe was of a neuralgic character, was very severe during the course of the disease, and varied as to its situation, sometimes being referred to the region of the cæcum, sometimes to the sigmoid flexures and descending colon, and sometimes to the region of the liver and spleen (no enlargement of these organs was detected). The abdomen was retracted, and pressure appeared to aggravate the pain. The pain was paroxysmal in character, usually commencing in the afternoon or evening and lasting from four to eight hours; while it existed the patient used to lie on his side, doubled up, and in great distress. On two occasions there was bilious vomiting associated with the attack of pain. The abdominal pain occurred daily from February 9th to 11th, when it disappeared, the temperature becoming normal (*vide* chart); it recommenced on February 19th, the day after the appearance of the second crop of nodes, and occurred daily until March 4th. From February 9th to 11th the patient gradually improved, and he was allowed to sit up on February 12th, but had to remain in bed on February 14th, owing to the painful condition of his legs when up. The temperature began to rise again on February 17th, and a profuse crop of erythema nodosum appeared on the legs on February 18th, this crop appearing about fifteen days after the first crop. Coincident with this he complained of considerable abdominal pain, which was more severe some days than others; occasionally morphia was necessary to allay it. Constipation existed throughout the disease. Owing to his general appearance—flushed face, dry furred tongue, abdominal pain and tenderness, high temperature and peculiar odour from the

body—it was thought that he might have enteric fever as well as erythema nodosum, but a Widal's blood test gave a negative result on February 26th. No cardiac murmur was developed during the disease. On February 24th he suffered from acute idiopathic orchitis on the left side, which gradually subsided under treatment. The temperature began to fall gradually on the 27th, coming down to 99° F. in the morning, and was normal morning and evening on March 6th. He was allowed up for an hour on March 14th, but could only sit with his legs elevated, owing to the pain which resulted when they were placed in a dependent position. Patient was extremely weak, and his convalescence, though uneventful, was very slow and prolonged. He gradually regained strength, and was discharged to duty on April 14th, after having been sixty-four days in hospital.

CLINICAL CHART.

Corps, Royal Irish Rifles; *Hospital*, Royal Infirmary, Dublin; *Rank and name*, Private J. Q.; *Age*, 19½; *Service*, ½ years; *Disease*, erythema nodosum; *Date of admission*, February 9th; *Result*, cure; *Discharged to duty*, April 14th.



Comments.—Erythema nodosum is comparatively rare in adults, and is usually seen at the outdoor department of hospitals, where it is generally looked upon merely as an interesting skin affection, whereas, as this case shows, it may be an acute disease, complicated with high fever and considerable abdominal pain; it may run a prolonged course, and be followed by marked debility. If it was not known that these febrile symptoms and severe abdominal pains, &c., are sometimes associated with the disease, some uncertainty might exist as to their diagnosis. After seeing the case which I have described, I cannot but think that the disease called erythema nodosum is more than a skin affection, and that it is probably a specific fever. What its relation, if any, is to rheumatic fever, I am not prepared to say. In this case the patient suffered from enlarged tonsils, from paroxysmal abdominal pain (which may have been neuralgic), from an attack of idiopathic orchitis, and from supra-orbital neuralgia. All these might be associated with a rheumatic diathesis. There were no lesions of joints, no muscular pains, and no cardiac affection.

A CASE OF MALIGNANT PUSTULE.

BY CAPTAIN JOHN TOBIN.

Royal Army Medical Corps.

No. 41218, Driver Connors, G., No. 5 Depôt, Royal Field Artillery, Clonmel, was admitted to hospital on May 3rd, 1906, suffering from a brawny swelling on the right side of the neck. In the centre of this swelling there was a brownish-black, dry slough, surrounded by a ring of small vesicles, and outside this an area of redness. The constitutional symptoms were of a severe type, there was a persistent cough, marked dyspnoea, accompanied at times with stridor, expectoration of blood-stained mucus, and a sense of constriction over the larynx. Temperature 102° F., pulse 120. Two hours after admission, assisted by Lieutenant-Colonel J. Riordan, R.A.M.C. (R.P.), the patient was given chloroform and we excised the pustule, including some of the surrounding healthy tissues. The raw surface left was thoroughly scraped with a Volkmann's spoon and swabbed with chloride of zinc. The excised pustule was examined by Major Jackson, R.A.M.C., S.H.O., Cork District, who reported that it was a case of malignant pustule. The patient made a good recovery, and is now quite fit, and will be discharged from hospital to duty in a few days.

IODIPIN AS A SUBSTITUTE FOR POTASSIUM IODIDE.

BY BREVET-COLONEL F. J. LAMBKIN.

Royal Army Medical Corps.

I WOULD like to bring to the notice of the officers of our Corps iodipin, as an efficient substitute for iodide of potassium in the treatment of syphilis.

Iodipin is a chemical combination of iodine and sessame oil. It is supplied in two strengths, viz., (1) as a 10 per cent. solution containing 10 per cent. of iodine; (2) as a 25 per cent. containing 25 per cent. of iodine. The former is used for internal use, the latter, except occasionally so, when it is given in gelatine capsules, is almost solely employed subcutaneously. Valuable as iodide of potash is as an adjunct to mercury in the treatment of syphilis, it possesses, unfortunately, some serious drawbacks, the principal one being that it is a depressant to the system; it is needless to point out the seriousness of this objection, and when taken for any length of time it almost invariably upsets the digestion.

For some months I have been using iodipin, subcutaneously, as a substitute for iodide of potash at the Military Hospital, Rochester Row, more especially among the chronic, or tertiary, cases of syphilis, which have been transferred there from Netley for further treatment, and I can now confidently recommend it in such cases. Its reaction is slower than that of iodide of potash, but it is more slowly absorbed and, what is of

greater importance, is much more slowly excreted from the system. It has been found to be still present in the blood one year after a course of 500 cubic centimetre.

Dosage, &c.—Iodipin is, for purposes of subcutaneous injection, first warmed to body heat, when it becomes more fluid and flows better through the needle. A syringe of at least 10 cc. capacity should be used. The needle should be wide channelled, and be 6 or 7 cm. in length. The injections are best made either into the tissues between the shoulder blades or in the gluteal region. The injections cause absolutely no pain or any other inconvenience. A course of iodipin covers ten days, during which time injections are given daily of from 10 to 15 cc. This massive injection might appear on paper to look objectionable, but as before stated I can vouch for it that it gives no trouble whatsoever. The one objection to iodipin is that it is expensive, but at present I only use it in the class of cases above named. It has no depressing effect on the system.

RECRUITING, NORTHERN COMMAND. OBSERVATION ON PHYSICAL TRAINING.

BY LIEUTENANT-COLONEL S. WESTCOTT, C.M.G.
Royal Army Medical Corps.

I HAVE for some time past been studying the effect of physical training on the recruit's heart. I have seen the instructors put the various squads through the gymnastic exercises which they performed at the parade previous to my inspection. After ten minutes' work I at first examined the heart every minute and soon determined that, as a general rule, five minutes were required for the resumption of the natural restful state, and this I fixed as the normal standard. At some dépôts a squad is occasionally found in which all hearts reach this normal standard, but this is exceptional, and the failures to reach it may occur in any proportion up to a maximum of 34 per cent. Of the 34 per cent. who do not recover in five minutes, the majority do so at varying periods within ten minutes. About 1-2 per cent. do not recover during the period of my inspection. The characters of the abnormal hearts vary infinitely: the nervous mechanism only may be deranged, or there may be structural changes, permanent or temporary. There may be found hypertrophy, atrophy, dilatation of cavities or orifices, or mere loss of muscular tone. Also apparently normal hearts with accelerated action, and small hearts beating rapidly for the same reason that a small man has to take two steps to a big man's one; then there is the heart acting excitedly from simple nervousness, or from some temporary cause of depression, such as a late night, or excessive smoking. These facts prove that all recruits are not of the same physique, but in accordance with the instructions they are regarded as such; they remain with the same squad during the period

of training, which I maintain is wrong in principle. It is customary in all schools or training establishments of every description, except for army recruits, to advance a pupil according to his ability, and this system, I suggest, should be adopted at the depôts. It would be greatly to the advantage of the Service were a recruit to remain in the lowest squad, both in the gymnasium and on the square, until he is physically fit to be advanced to the next; some men are fit to be promoted a few days after joining, others may never be fit. The system of urging the weak and delaying the strong is not conducive to the efficiency of either.

It is possible that the present system may to a certain extent account for the increase of losses to the Service attributed to heart defects, and a change in the principle of training is justified on this ground. The hearts of the majority of recruits are capable of resisting considerable pressure, but a large minority have never been exercised during the lives of their possessors, and as it is undesirable to select the weakly ones for marked attention, I suggest that no recruit should attend the gymnasium during the first fortnight's service, but that this period should be allotted to vaccination, feeding, and gentle exercise in the open air. During the second fortnight gymnastic training should be commenced, but no fixed apparatus should be used. Training commenced thus gently is more likely to result in a higher standard of physical fitness during the later periods without the risk of early breakdown.

Echoes from the Past.

ON THE MEDICAL ORGANISATION OF THE BASE OF OPERATIONS IN WAR TIME.

BY SURGEON-MAJOR G. J. H. EVATT, M.D.

Army Medical Staff.

[Now Surgeon-General G. J. H. Evatt, C.B., A.M.S., (R).]

[It has been suggested that this article should be printed as an "Echo from the Past," and as an historical record of what the advanced opinions which, twenty years ago, were regarded as essential to successful work in war, it is a veritable "echo"; but there is so much in it that has yet to be realised that it is not a mere interesting reflection of a dead "past," but an incentive to achievement in the perennial present, for we still fall short of Surgeon-General Evatt's ideal of 1885. Our existing organisation is not, in some respects, comparable with that set forth in these pages, for in it it is assumed that the base is the head-quarters of the line of communication, and much of the administrative duty

that is allotted to the Medical Staff at the base now devolves on the Medical Directing Staff of the line of communication. The headquarters of a line of communication may be located at a base, but the tendency is to push the head-quarters up the line and to confine the duties of the base Staff to those connected with the passing through of *personnel* and stores. When this is possible great advantage must ensue from the decentralisation that results. An ideal base in an over-sea expedition would consist, from a medical point of view, merely of a port where troops and stores would disembark and be entrained, and where the sick would leave the train to embark for home. Troops should be passed through a base, and if this is possible the problems at the front are enormously simplified. The duties of the Base Sanitary Officer should be confined to the harbour where troops disembark and entrain. The duties of the Embarkation Medical Officer, General Executive and Medical Transport Officers are similarly simplified. If such an ideal could be achieved the base hospital might disappear. The term is no longer recognised, although, of course, general and stationary hospitals may be located there; but a base hospital is no longer an essential part of our organisation.—ACTING EDITOR.]

INTRODUCTION.

I propose in the following brief paper to deal with the question of the organisation needed at the base of operations by the Medical Corps of an army in the field to enable the Medical Service to do its duty with efficiency, and according to the demands of modern ideas as to the working of a Medical Corps in the field.

We are now going through the constructive stage of Military Medical Organisation. We have really no tradition of the past to copy implicitly as a guide for our work. We have to-day to originate, to lay down first principles, so that those coming after us may have easier work to do and more to guide them in doing it than has been our lot.

We should take courage in this matter from the enormous progress made in military medical organisation between the years 1882 and 1885, and should remember that between these few years the *personnel* of the field hospitals was practically doubled. We have now to deal calmly and accurately with the subject of medical organisation at the base of operations in war time. Its efficient working is of paramount importance to the success of the army, and that efficiency can only be achieved by thoughtful forecasting of its needs in peace, and laying down a definite scale of officers, men, and material for its due working.

In foreign armies fighting on the mainland of Europe, and starting from their garrisons for the field, practically their whole country is for them a base of operations, and the German Army can draw supplies of men and equipment from the whole extent of the German Empire in war time.

With us it is quite different. Our armies are flung down on a hostile coast; they have to land all their supplies often at a single and perhaps indifferent port, and all the vast converging mass of men and *materiel* coming from England have to pass through the narrow tunnel of the base of operations before they again expand into the army in the field. The base is like the narrow constriction in the centre of an hour-glass, the upper division of which may represent England pouring out her supplies with a lavish hand from her shores, every particle of which must run through the base before it again expands into the lower division which represents the army spread out in the field. For the Medical Service the highly important fact has to be borne in mind that in addition to landing all its *personnel* and *materiel* from England at the base, through that base must also re-pass the whole of the sick and wounded returning from the field to England; and further, that large accumulations of sick and wounded are likely to be collected for treatment in and about the base itself.

We should now in peace time quietly think out what machinery is needed at the base of operations to discharge this duty, and openly submit the demands to English public opinion, so that everyone in the nation may know what the Medical Service of the army needs for its successful administration in war.

We must put on one side altogether the idea that the nation will not grant the men needed, or that it will refuse the extra cost needful establishment will entail in the war estimate. This is not the case. It is quite certain that if we can calmly and accurately show the need of the special aid we require it will certainly be granted. This labour of accurately studying our needs in peace for war is one only beginning in every branch of our army, but it is certain that without this preliminary study successful war cannot be made. The whole history of the past in the Medical Service has been the highest, fullest, and most excellent aspirations on the part of the medical officers to succeed in war, and with this a complete absence of the means of reducing these aspirations to the level of practical work.

It is no use theorising as to what we are to dream of in a future campaign; the true course is to frame a clear demand for so many

officers, men, *matériel* and transport, and say definitely that without these success cannot come. All happy-go-lucky makeshift endeavours are not organisation. Organisation is above all things accurate definite forethought applied in peace to the study of the national needs in the field.

Up to the present I cannot find that any single military leader has ever thoroughly gone into the question of medical field organisation, however ready they may have been in the field to blame all short-comings. To-day we are doing this work for ourselves and endeavouring to educate public opinion on this matter so important for the well-being of the Army, particularly in its lower grades.

The subject of the medical organisation at the base of operations may be considered under the following heads:—

Section I.—The Principal Medical Officer at the base. His staff, &c.

Section II.—The Sanitary Officer at the base.

Section III.—The Medical Transport Officer at the base.

Section IV.—The Medical Charge of the Base Military and General Staff.

Section V.—The Medical Store Depôt at the base.

Section VI.—The Base Hospital.

Section VII.—The Hospital Ship.

Section VIII.—The Sick Transport Ship for England.

Section IX.—Medical Staff Corps Depôt at base.

Section X.—Reserve hospitals parked at the base.

Section XI.—The Statistical Officer to the Army Corps.

SECTION I.—THE PRINCIPAL MEDICAL OFFICER AT THE BASE.

The Principal Medical Officer of the base is one of the most important officials needed in the medical corps of an army in the field, for on his energy depends much of the successful working of the whole medical field system. He should be active, of good physical health, and able to endure fatigue. It is a question of the existing age of retirement for deputy surgeons-general, viz., 60 years is not much too high, and that an officer who has to undergo the physical labour now demanded of a deputy surgeon-general should not retire at 55 years of age. These last five years from 55 to 60 years are the last straws on the camel's back, and officers full of tropical service, and who have seen several campaigns, are not well fitted when over 55 for such active work. With surgeons-general it may be different—but for deputies, 55 should probably be the age of retirement.

The P.M.O. on leaving England should take with him, in the same vessel, his secretary, who should be a surgeon-major. This officer should be the office assistant and representative of his chief, and should sign all routine letters, returns, and orders "by order" for him. No secretary is allowed to the P.M.O. at the base by the existing field service regulations, and anything more painful than the result of this absence of a secretary cannot be imagined. It is painful beyond measure to see old and experienced officers filling this post, wearied and tired out with petty routine details.

To send a P.M.O. to work the base and to give him no secretary, is to run the risk of failure in war with our eyes open. If the P.M.O. goes from his office to a board, or to visit the base hospital, or to inspect the hospital ship, a constant and important duty, one finds his office empty and some sergeant in charge. This is completely wrong. We cannot do our duty or speak with sergeants on important confidential subjects such as medical matters are. Even if we in the medical service did discuss matters with sergeant-clerks, other officers of other branches will certainly not do so, and thus hitches, misunderstandings, and failures occur. The secretary should be always on the spot in the absence of his chief, and should be fully aware of all the various lines of work at the base, so that if the P.M.O. goes sick, or is invalided, the whole working may not collapse, but the new P.M.O. will find the office work going on fairly under the secretary when he takes charge. We cannot dwell too strongly on the need of this officer. He may cost £500 a year for his pay, but in the war charges this is nothing, and without him a P.M.O. cannot do his work and failure is quite certain to occur. This should be clearly understood, and none will deny it. There is no doubt whatever that our P.M.O.'s are to-day completely overburdened with petty details in the field, owing to the absence of secretaries.

During the whole of the voyage out the P.M.O. should discuss matters with his secretary and lay down his system of work, and if others of the base staff be on board with him he should call them together frequently and regularly drill them by lecture and explanations into what his system of work may be.

There is no great difficulty in working the base if this be done, but if all the base staff land ignorant of their work and have to learn it there, confusion will result.

Doubtless this base organisation routine should form part of the senior examination now introduced into the department.

The P.M.O. of the base is, of course, subordinate to the P.M.O.

of the communications line, but within the base itself he has a free hand and full power to act. The P.M.O. of the communications is really a travelling Inspector-General, whose power extends from the immediate rear of the army in front to the extremest point of the base towards England. This communications P.M.O. should probably be perpetually on the move up and down this line, and he really is the vivifying influence along the whole line. It is difficult to over-estimate the importance the efficient working of the line of communication bears to the medical service. It is the very basis of good medical war work that the communication be well organised. To-day, of course, we deal merely with that section of the communication called the base of operations. In addition to his secretary the base P.M.O. needs a junior officer of active habits and good address as his orderly officer. There are a great number of points which come under the P.M.O. of the base which can be settled at once by a personal interview, or by a personally delivered message, and for this purpose an orderly officer is of great importance. Practically all P.M.O.'s in the field strive to develop such an officer, but he is only to be obtained by filching him from one of the medical field units, which unit is thereby injured in its efficiency. The true method is openly and boldly to say to the nation that such aid is needed to ensure the efficient working of the base. Tradition gives us no aid in this matter. The chaos of Scutari teaches us not what to copy, but rather what to avoid. Deficiency of staff is the thing we must avoid.

So far as I have seen of army life the short-handedness of the medical corps in its war work receives not the slightest sympathy from the army generally. They rightly think that it is entirely our own fault in not openly stating our needs and referring the matter to those who know what labour war really is. If England desires her soldiers to be cared for when ill she must grant the staff needed for the work, and I have in every case found that the military officers simply wondered at our going into the field short-handed. The need of secretaries is of paramount importance to us, not only at the base but at the divisional headquarters, where the P.M.O.'s are entirely devoid of secretarial help, being in this way far worse off than any other commanding officer of a corps. The very lives of the P.M.O.'s are at stake in this question of continuous overwork from petty details which should fall on secretaries.

The P.M.O. of the base takes out with him in the same vessel his sergeant and private clerks. These are trained disciplined men of the Medical Staff Corps, and there should be a sufficiency of

them. On the voyage out the P.M.O. explains to them his line of work and allows them to attend any lectures he gives to the medical officers on the subject.

In addition to these and quite apart from them are his messengers, of which he needs probably three. There are also M.S.C. men, who know the meaning of the medical unit, designation of officers, &c., &c.

These men are lodged in the tents with the clerks and are rationed and looked after by the orderly officer of the P.M.O., who also rations the servants, looks after the horses, and attends to all the minor details of the P.M.O.'s camp in addition to his other duties.

Mounted orderlies are also needed and should be supplied from the mounted corps at the base, or the transport dépôt should supply ponies or horses for the messenger orderlies, which probably is the simplest way of arranging matters. The loss of time in using foot messengers over a large base is considerable.

Great advantage results from joining the base hospital and the hospital ship to the P.M.O.'s office by telephone, or by flag signals, and by laying down a few simple signals referring to transfer of wounded to the ship, &c.

The P.M.O.'s offices are, of course, near the base commandant's office, and ought to be distinguished by a red cross flag and by a large conspicuous notice board, painted in white on black with the words P.M.O. of Base Office. In war camps label everything, so that he who runs may read.

In addition to the flag and the notice board, at night a lantern should be used, as constant messages at night may arrive and the P.M.O.'s office should be easily found. One of the messengers should always be on the *qui vive* to receive messengers arriving and show them the office where one of the clerks sleep as if on guard there.

When the P.M.O. goes out on inspections, his orderly officer should accompany him with all note books and documents needed, and the secretary should remain in the office. It should be the rule that either the P.M.O. or his secretary should at all times be in the P.M.O.'s office. If both are away the public service is distinctly injured, and this is intolerable and means failure in war. The delay of half-an-hour in carrying out an order may entail great loss to the nation.

The P.M.O. of the base is now responsible for the clothing accounts and for the pay documents of all the Medical Staff Corps employed in the campaign. This is a frightful trouble, and one from which the P.M.O. should be completely freed.

During one of my campaigns I could not get a pair of shoes for one of my men without the counter-signature of the base P.M.O., an overworked official who lived thirty miles away from my post. All this clothing and document work should be handed over to the Officer Commanding Medical Staff Corps Dépôt at the base, who should be completely responsible. Of this officer and dépôt we shall speak presently.

Wherever the ordinary landing place of the troops may be, a printed notice board should be fixed there stating where the P.M.O. of the base has his office. This is very useful, and constant care is needed to distinguish the base P.M.O. from the *chief medical officer of the base hospital*. These two officials are constantly confused with one another by the uninitiated, and even by the rank and file of Medical Staff Corps who should know better.

In referring again to the need of secretaries for the different higher medical officials, we must remember that the secretaries learn an immense deal by their appointments, and this knowledge so learned while young, fit them as they grow old for the filling of the higher posts themselves. In fact a tradition is formed.

In all these attempts to free senior officers from overwork, and to develop new officials where needed, the aim is, of course, a double one. First to do absolute justice to the individual by freeing him from overwork, which may be beyond the limits of human endurance, and which if persisted in may permanently injure the health of the officer, but still more to paralyse and to remove altogether all excuses for work ill done. This has to be guarded against with the whole official class. They remain silent before the strain comes upon them, although they must know if they study their wants that failure is inevitable, then when they fail they trot out the excuse of overwork. The aim of the nation is to remove all reasonable hindrance to good work, to place ample means ready to do the duty, and in case of failure to demand full enquiries and insist on punishment.

SECTION II.—THE SANITARY OFFICER AT THE BASE OF OPERATIONS.

Whoever may be appointed as sanitary officer at the base of operations of an army in the field has certainly his work cut out for him. He has before him arduous, unceasing and unpleasant work, which will as a rule bring him into contact with everybody at the base, and he needs much strength of character to carry out his duties.

So fully will he be occupied that all idea of his fulfilling any other duty save sanitary work is completely out of the question. Under existing rules he is to combine the duties of sanitary officer, with superintendence of the embarkation of sick and wounded. It may safely be said that no one officer can carry out accurately such duties. The base of operations is the most difficult place to keep in a sanitary condition. Thousands of soldiers pass through it, staying only for a few days, and all the time in such confusion that sanitary neglects are certain to occur. To the base come crowds of contractors, sutlers, and the rabble which follow an army. Such persons are completely undisciplined in sanitary routine and set at defiance all orders on the subject. To the base come hundreds of animals of every kind for transport purposes, as well as for the food of the army. These alone create enormous trouble from a sanitary point of view.

Epidemic disease is more likely to develop at the base than elsewhere, because ships arrive with men and animals from all points of the compass, and disease loves to revel in such agglomerations.

At the base are landed vast supplies of food for the army, all needing to be watched, so that the rascality of contractors may be checked.

Every ship arriving in the harbour has to be inspected to see if infectious disease exists.

All this is for one officer a heavy task, and it is simply impossible for him to take over the sick transport duties of an army corps if he is to do his duty fully. That duty is in itself most onerous.

The brigade-surgeon appointed as sanitary officer is of course simply the staff officer of the P.M.O. of the base, who is finally responsible in all sanitary matters, but who uses the sanitary officer as his agent and executive officer.

The sanitary officer has his office close beside the P.M.O.'s office, with whom he is in constant communication. His office is labelled with a signboard, clearly and distinctly, with his official designation so largely printed as to be visible at a distance. If at all possible he plainly posts up that at a certain hour in the morning and a certain hour in the evening he will be found at his office, so arranging as not to interfere with his out-door work, which is of the chief importance.

He sets up near his office a set of meteorological instruments, which should be supplied to him before leaving England, and he causes a correct observation to be made of the conditions of the weather by one of his clerks.

He arranges with the medical store dépôt at the base to form, either at the dépôt, or near his own office, a temporary laboratory where a more accurate analysis of water or food may be made than is possible in the front of the army. Samples of water are frequently sent back to the base for examination, and samples of the food and drink for the army may be tested there also.

He needs a quartermaster, or other officer of the quartermaster-general's department, to be placed under his orders as an executive officer for the carrying out of the general sanitary work. He needs a certain number of sergeants, either from the Medical Staff Corps dépôt at the base, or from the troops or police at the base, as assistant inspectors, to report to him daily as to their districts.

He, in conjunction with the Base Commandant and P.M.O. of the base, decentralises the sanitary responsibility to the various corps and departments, marking off accurately the space of ground for the sanitary care of which they are each responsible, and arranges with each unit that a certain number of their men are told off specially as sanitary fatigue men, or pioneers to keep the place in order.

He keeps under the central authority such portions of the camp or town as cannot be conveniently told off to special corps, and for the cleansing of these portions he arranges with the Q.M.G.'s department that a company of the regiment doing duty at the base is regularly handed over complete as sanitary police. If it be a tropical country he utilises these men, not as workers, but as inspectors and district chiefs over native labourers, causing them to report daily to him of any defects.

He arranges for the construction of latrines and urinals in all public thoroughfares where crowds of men pass, and which can hardly be handed over to corps or departments to keep in order.

He moves the Q.M.G.'s people to provide such transport, either cart, or pack, or human, as will be sufficient to remove the filth from the collecting places in the camp or town.

He arranges for the formation of a quarantine dépôt for all suspected or infectious disease cases, and he obtains a detachment of Medical Staff Corps to look after it.

He visits all butcheries and cattle yards, and sees that all cattle landed are in healthy condition and fit for food.

He visits the great bakeries at the base and sees that the flour is good, the water supply suitable, and the workers themselves clean and healthy, and that no sewage pollution exists.

He inspects the sutler's stores and condemns all bad supplies,

and reports to the Commandant all liquor shops existing against orders. In those shops where liquor is sold he sees that it is good.

He watches the brothels and the vagrant prostitutes that follow in the train of all armies, and if needful arranges for their registration and inspection.

He watches most carefully the condition of the shipping in the harbour, and either by himself, or by a naval surgeon told off as his assistant, has frequent inspections of the crews.

He notes the condition of the harbour, often loaded with floating sewage matter; and if needed he forms a marine sanitary corps to keep it clean. If on the sea coast, he needs sewage boats to convey the filth of the camp outside the harbour and there throw it into the sea.

He needs so many steam launches with crews told off by the naval transport officer to tow out the filth boats to the sea to be emptied.

He inspects every vessel arriving, especially vessels with native labourers, or men from the Levant.

He notes that the transport department tell off from their own corps a permanent burying party to inter all dead transport animals; and that the commissariat slaughtering subordinates have the means of removing entrails and offal for burying outside the camp.

He notes the water supply and marks off the wells, &c., for washing and drinking purposes.

He receives weekly, from the medical officer of the base hospital, or the medical officer in charge of the staff at the base, reports of prevailing sickness, and keeps himself *au courant* with the statistical condition of the army as regards diseases which may be preventable.

He frequently inspects the cemetery or burial ground chosen for the base, and he sees that the graves are dug of a sufficient depth, and that an engineer N.C.O. is told off by the engineer officer at the base to look after it, to keep a plan of the ground and the graves, and that the place is securely fenced in and protected from wild animals.

In his capacity as a staff officer of the P.M.O. of the base, he has the full right to visit and inspect and report upon the sanitary condition of the base hospital, its grounds, latrines, and every sanitary detail—even though the medical officer in charge be his senior. He submits his report to the P.M.O. of the base, who moves the medical officer of the hospital to make any needful

changes. He visits the hospital ship in the same way, reporting on all overcrowding, or on any unsanitary condition which may be prejudicial to the welfare of the sick. Being the staff officer of the P.M.O. of the base he passes freely through every place, as on "inspection duty."

He forwards to the P.M.O. of the base for record weekly, a statement that during the week he performed certain duties, viz. :—

That he inspected the Camp or Town and finds it—

"	"	Bakeries.....
"	"	Butcheries.....
"	"	Transport Lines
"	"	Quarantine Dépôt
"	"	Water Supply
"	"	Burial Grounds
"	"	Base Hospital
"	"	Hospital Ship
"	"	Sutler's Stores
"	"	Commissariat Cattle Dépôt
"	"	Brothels and Licensed Houses
"	"	Drinking Canteens
"	"	Harbour Sanitation.....
"	"	Filth Boats
"	"	Conservancy Transport
"	"	Sanitary Laboratory
"	"	Meteorological Instruments

(To be continued.)

Reviews.

LA FIEVRE MÉDITERANÉENNE EN TUNISIE. Nos connaissances actuelles sur. Dr. Felix Cardaliaguet. Published by Imprimerie Commerciale, 53, rue du Hautoir, Bordeaux.

Of recent years our French confrères in Tunis have been taking a great interest in the existence in Tunis of cases of Malta or Mediterranean fever. Dr. Hayat of that city, some two and a-half years ago, took it as the subject of his graduation thesis. From time to time Dr. C. Nicolle, Director of the Pasteur Institute of Tunis, has published in the *French Medical Press* cases, with bacteriological observations thereon; and just recently Dr. F. Cardaliaguet a brochure of some eighty pages, inscribed as above.

After a brief sketch of the disease in general, which includes the work embodied in the first three volumes of "Reports of the Mediterranean Fever Commission," he enters upon its existence in Tunis as follows:—

Historical.—It would appear it was first described in Tunis as a separate entity by Dr. Morpurgo, in 1894, who then regarded it as a variety of typhus; the first complete clinical description of it under its

present name being given in 1900, by Dr. G. Funaro, who declared he had observed cases at Tunis prior to 1878. The identity of the cases observed with the type found in the neighbouring island of Malta, was much disputed till the point was set at rest by the isolation of *M. melitensis* from the spleen of a patient by Dr. C. Nicolle, in October, 1904. This was followed by the recognition of other cases, but up to July, 1905, this fever, though sought for elsewhere, had only been observed amongst Maltese and Jews, but in February to March, 1906, it was observed in one European and several indigenous Mussulmen.

Clinical.—The description given is practically entirely in accord with that of English writers.

Diagnosis.—By clinical and laboratory methods, the latter being: (1) the recovery of *M. melitensis* from spleen, blood, &c., of the patient; (2) the sero-diagnostic of Wright (agglutination reaction); (3) the blood count. "One notes always in Mediterranean fever an intense 'mononucleose.' The 'formula leucocytaire' is then a precious indication." The normal is taken at 29 per cent. of mononuclears and lymphocytes and 70 per cent. of polynuclears, and observations are given showing that in Mediterranean fever the former are increased to 48 or even 80 per cent.

Prognosis.—Favourable, mortality almost *nil*.

Treatment.—Entirely in accord with English ideas.

Etiology.—Though recently observed in a European and some Mussulmen, it is, nevertheless, amongst Maltese and Israelites that it has been most frequently recorded. "Note, that it is with these populations that bad hygiene and poverty develop also other infections." Dr. Cattani considers the path of infection to be the gastro-intestinal canal, and the vehicle to be goats' milk, also that the race most frequently attacked is the Jewish, and asks if that frequency is not due to the consumption of milk of almost exclusively goat origin, which the Israelite population practise. In a discussion at the Société des Sciences Médicales de Tunis (1903), it was maintained that cases were more frequent in the low-lying parts of Tunis, and this was attributed to defective sewers. Dr. C. Nicolle has recently been examining the goats of Tunis. Out of twenty-seven goats of Maltese origin, three gave a serum agglutination reaction to *M. melitensis* of one in twenty, five a reaction of one in ten, that is eight out of twenty-seven, or 30 per cent.; out of thirteen Tunisian goats one gave a reaction of one in twenty and four of one in ten, that is, five in thirteen, or 38 per cent. Two of the goats, with a serum reaction of one in twenty, were selected for further examination; their milk had no agglutinating power and cultivated yielded no *M. melitensis*. "There are in effect 2,500 goats at Tunis, and further investigation is necessary."

Cases.—Eighteen are published with full clinical details.

The author concludes with a very complete bibliography of the disease, and is to be congratulated on his exposition of what is to many of us a very interesting subject.

E. A. SHAW.

NOTES ON MILITARY SANITATION. By Lieutenant-Colonel H. P. G. Elkington, R.A.M.C. To be obtained at St. John Ambulance Association, St. John's Gate, Clerkenwell, London, E.C. Price 1s.

This excellent little book is a step, and a very important one, in the direction of teaching the soldier and the nation generally that the sanita-

tion of the Army depends in the ultimate issue on the individual effort of each person in that Army. The lines on page 43, "Here one must again point out that the *individual man* is the one on whom responsibility rests; without *his* co-operation nothing can be accomplished," might well be embodied in Regulations. They strike in the clearest and most unmistakable way the key-note of all Military Sanitation. The book throughout is written in the most practical manner, and important points are not allowed to lose their weight by being over laboured. Though intended primarily as a manual for non-professional persons, it might be read with profit by all Medical Officers, and no Regimental Officer who takes a practical interest in the health of his men should hesitate to study it most carefully.

C. H. MELVILLE.

Current Literature.

Human Tick Fever.—(I) In the *Journal of Tropical Medicine* for March, 1906, a paper on this disease, as met with in Uganda, is written by Dr. P. Ross. His history of the disease in Uganda may be supplemented by the following facts, which are not mentioned. He states that: "Cook, of the C.M.S. Hospital, Mengo, also found spirochæte in a fever patient. This latter writer had probably seen but not recognised the organism some two years before." Cook's paper in the *Journal of Tropical Medicine* for January 15th, 1904, is not given in the list of references. Cook had seen motile bodies in the blood of a patient some time before the Sleeping Sickness Commission of the Royal Society reached Uganda. The Commission, shortly after their arrival in March, 1903, discovered a spirochæte in the blood of a patient supposed to be suffering from sleeping sickness, but really from tick or spirochæte fever, *vide* Report V. After this observation Cook's paper appeared in the *Journal of Tropical Medicine*. As no mention of these facts is made it is desirable to call attention to them here. In the clinical account of the disease no reference is made to eye complications, which occasionally occur in this disease.

(II.) In Memoir XVII. the Liverpool School of Tropical Medicine issue a report on "The Nature of Human Tick Fever in the Eastern part of the Congo Free State," by the late Dr. J. E. Dutton and Dr. John L. Todd. In this report the authors give a description of several cases, both native and European, including an account of their own, as both of them suffered from tick fever, Dutton dying a month after the last attack; but it is stated that no spirochætes were seen during his fatal illness. In the experimental work they inoculated a number of animals. They state: "To monkeys alone, the *Cercopithec*i, especially young animals, does it seem uniformly pathogenic. An adult rabbit was refractory. A young rabbit and a rat, in whom there were grave accompanying affections, seemed more susceptible. A large guinea-pig showed spirochætes in its blood for only two days succeeding the inoculation of a large dose of

heavily infected blood; in it, as in three rats from whose blood spirochætes, once present, finally disappeared, there appears to have been temporary increase in the number of parasites, and dividing forms were seen." They were successful in proving that the spirochæte can be introduced into healthy animals by the bite of a tick, *Ornithodoros moubata*, taken from infected houses.

The conclusions they arrive at are :—

- (1) Tick fever is clinically identical with relapsing fever, and has for its pathogenic agent a spirochæte.
- (2) The spirochæte is probably *S. obermeieri*.
- (3) The tick, *O. moubata*, can transmit the spirochæte from animal to animal.
- (4) The transmission is not merely mechanical, but some developmental process is carried on in the tick.
- (5) A considerable degree of immunity or tolerance to the spirochæte can probably be acquired.

(III.) In the *Lancet*, of March 10th, 1906, Breinl and Kinghorn, of the Liverpool School of Tropical Medicine, contribute a paper on tick fever. Working with the strain of spirochæte which Dutton and Todd used in the Congo, they state: "We have been able to infect with the spirochæte of African tick fever in addition to monkeys, a horse, a dog, rabbits, guinea-pigs, rats and mice. The rabbits, rats, mice and some of the guinea-pigs, have succumbed to the infection. Previous observers have not been able, so far as is known up to the present, to infect any animal other than monkeys with *S. obermeieri*. These experiments lead to the conclusion that the spirochæte of the African tick fever differs from the *S. obermeieri*."

The further experimental study of this interesting disease would undoubtedly increase our knowledge on many points.

E. D. W. GREIG.

The Determination of Typhoid Bacilli in the Blood.—In the *Deutsche Med. Wochenschrift*, No. 2, of January 11th, 1906, Conradi gives an account of a method devised by him for the easy detection of typhoid and paratyphoid bacilli in the blood. The principle of the method is that by mixing the blood at once with bile the coagulation, and hence the production of bactericidal bodies, is prevented, and further, the bile forms an excellent medium for the development of the bacillus. In order to increase the anti-coagulation action of the bile 10 per cent. peptone is added, and to hinder the development of saprophytic organisms 10 per cent. glycerine is also added. The medium is prepared in the following way: About 90 cc. fresh ox bile is mixed with 10 g. peptone sicca, Witte, and 10 per cent. glycerine added. It is sterilised at 100° for two hours. About 2 to 3 c.cm. of the clear unfiltered fluid is poured into sterilised glass tubes about 9 cm. in height and 18 mm. in diameter, and these are closed with a rubber cork. To collect the blood, sterile capillary tubes, about 18 cm. long and 2 to 3 mm. in diameter, the lower end being drawn out fine and the upper end closed with cotton wool, are kept ready. The lobe of the ear is carefully washed with soap and water and then with ether. A deep stab is made into the lobe of the ear and when the blood wells out the capillary tube (into which a very small quantity of the bile mixture has

been allowed to flow to prevent coagulation) is applied and the blood allowed to run in; when the capillary is half full the contents are at once transferred to the tube containing the bile mixture, which is kept ready. This operation is repeated until the blood ceases to flow. In this way it is easy to get from a $\frac{1}{2}$ to 2 cc. of blood, or 3 to 5 cc. may be drawn from a vein by a syringe. The proportion of blood to bile mixture should be as 1:3, hence it is as well to mark on the outside of the tube with a glass pencil the level of the bile mixture before adding the blood. These tubes containing the blood and bile mixture are then placed in the incubator at 37° C. for ten to sixteen hours. At the end of that time one half of the contents are removed and plated on Drigalski-Conradi agar in the usual way (see paper by Greig in this Journal, February, 1906). These plates are placed in the incubator at 37° C. for sixteen to eighteen hours, and then examined for the typhoid bacillus in the usual manner. If these plates do not show the bacillus another series can be prepared from the remainder of the blood and bile mixture, which has been allowed to incubate for a further period of sixteen hours. The diagnosis can as a rule be made in from twenty-six to thirty-two hours, the tubes containing the blood and bile mixture being sent to the laboratory in wooden boxes and at once placed in the incubator.

Using this method Conradi has obtained the following interesting results: In the examination of twenty-eight cases of typhoid fever he cultivated the typhoid bacillus twenty-two times and the paratyphoid bacillus six times from the blood of the patients. In eight cases he recovered the bacillus from the blood in the first week of the disease and five times before the blood gave the Widal reaction. He has also obtained the bacillus from the blood of convalescents who were entirely free from fever, not only in those who had suffered from a typical attack of the disease, but also from those who had only been ill for a few days. From this it will be seen that the entrance of the bacillus into the blood does not necessarily produce severe clinical signs in typhoid fever. Further, Conradi has shown that the number of the bacilli found in the blood has no relation to the course of the disease.

E. D. W. GREIG.

On the Action of Brillantgrün on *Trypanosoma brucei*.—In the *Zeitschrift für Hygiene und Infektionskrankheiten*, Band lii., February, 1906, Professor H. Wendelstadt and T. Fellner give an account of their experiments with this substance. It is the sulphate of tetræthyldiparamidotriphenylcarbonols. The authors have made observations on rats, monkeys and dogs. The following are the results which they have obtained:—

(1) That brillantgrün causes the *Trypanosoma brucei* to disappear with certainty from the blood of rats and dogs in which it was previously swarming. The lives of rats and monkeys can be prolonged by treatment with brillantgrün. A combination with arsenic increases its action and under certain circumstances produces a cure.

(2) The blood of an infected rat or monkey, which has been treated with brillantgrün, is for a certain time not infectious.

(3) With the degeneration of the ordinary trypanosomes in the blood, following the administration of the brillantgrün, quite definite forms, showing cyst formation, appear. They believe that these cysts have some

Correspondence

significance in connection with the further development of the trypanosomes. Since by means of brilliantgrün, the normal forms of trypanosomes are killed off, it is possible to make a more complete study of the degeneration forms, the study of the further development of the trypanosomes is made easier.

(4) The further development probably takes, place in the spleen; whether also in other organs has not yet been determined.

In connection with the degeneration forms the authors state that they find in the blood of infected rats, which have been treated with arsenic and brilliantgrün, that the white blood corpuscles have taken up the parasite, and they consider that they are morphologically identical, in this condition, with the Leishman bodies. These forms are contained in the leucocytes in the circulating blood, whilst the Leishman bodies are, generally, only found in the smears from the spleen. The authors observed that in the spleen of treated rats a further development of these cysts into fully formed trypanosomes took place.

They also observed that when the blood containing these degeneration forms was mixed with neutral red in hanging drop that a number of brownish-red, cocci-like forms, which were mostly arranged in pairs and showing active trembling movement, were observed. These bodies frequently appeared to attach themselves to the red blood corpuscles. The exact significance of these forms could not be made out.

The different appearances described in the paper are clearly illustrated in a plate which accompanies it.

E. D. W. GREIG.

Correspondence.

ENTERIC FEVER: A WATER-BORNE DISEASE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The excellent paper on this subject, by Major Faichnie, which appeared in the May number of the Journal, deserves the serious consideration of every officer in the Army. There is one point on which he lays stress, and I think rightly so; it is the frequent possibility of pollution of safe water by storage in infected vessels. Now, this is a factor which we, as sanitary guardians of the soldier, have neglected too long. Probably nowhere does this occur more often, on service, than by means of his water-bottle. Unless that bottle is systematically supervised, or the soldier placed in a position to sterilise it himself, once filled with infected water, that bottle becomes a source of infection of otherwise pure water for days after. It needs no imagination to picture the sequence of events, the experiences of every officer will emphasise the truth of this statement and the magnitude of the danger.

The question arises, if this is so, how can it be prevented? The

answer of most men will be, explain the facts and risks to the rank and file and let the soldier's officer see personally that the man washes his bottle out daily with a safe and clean water. Apart from the practical difficulty in getting this done, at least on field manœuvres or in actual time of war, we know that it will take very much more rinsing or washing out to rid the bottle of any contained infection than ever we shall be able to get a soldier to do, even if supervised by his own superiors. To me the solution of the difficulty is comparatively simple. Let each soldier be provided with, and carry on his person, means for sterilising his water-bottle daily. By using tablets containing a sufficiency of some suitable re-agent, he can do this with a minimum of trouble to himself. To specify but one such suitable re-agent, we have in sodium bi-sulphate a means at once portable, simple, effective, does not render the bottle contents undrinkable, and is free from risk by misuse. If the soldier, but once a day, placed one or more tablets, representing fifteen grains, of this re-agent in his water-bottle and left them there for half an hour, or until such time as he wished to drink its contents, the possibilities of persistence of infection within that bottle from day to day would be remote, if not non-existent. Doubtless some will say quite impracticable. I maintain that it is practicable: there need be no more difficulty in seeing that a soldier has his supply of water-bottle purifiers in his pocket than it is to see that he has the bottle itself, or that his pouch contains cartridges. The essential needed is to make the actual issue of these tablets to the men, after explaining their object and use.

I do not make this suggestion rashly. My present duties bring me in intimate communion with soldiers as regards practical sanitary effort, and when I talk to them on this point, as I now write, not only to my brother officers, but to the army at large, I am astonished at the avidity with which they welcome the idea as absolutely feasible. The average soldier is no fool, and has no special wish to contract either enteric, dysentery, cholera, or any other water-borne disease. He is ignorant on many points of etiology, but if these points are put to him plainly and dogmatically, he is quick to recognise how they concern himself. We shall never be able to secure sanitation in the army by order, something more than issuing an order to do this, or not to do that, is needed: we must take the soldier into our confidence and appeal to his innate sense of self-preservation. So in this matter, let us take the soldier into our confidence, give him these means of keeping his water-bottle free of infection, in anticipation of the day when he will be obliged to fill it with water which has not been rendered safe; let us explain their use, and I am sure that five out of seven men will avail themselves intelligently of the sanitary asset put into their hands. I hope to see the experiment tried; it will be no question of issuing water which has been sterilised by chemicals; it will be a mere matter of sterilising daily the men's water-bottles by means of chemicals, and this done by the men themselves. To

be of any value the scheme must be carried out thoroughly and the issue made regimentally; in other words, small tins or boxes of these tablets must be as much a part of the quartermaster's stores as are boots or coats. Assume that a man had a small tin or bottle containing a hundred tablets, if he used but three a day, putting them into his water-bottle on filling it over night or at the beginning of his day, that tin would last him a month. Should a man lose his tablets, he must and should be supplied with more from the regimental store. The inception of this scheme would be associated naturally with some difficulties, doubts, and perhaps covert hostility from the ignorant and prejudiced; but, if the Japanese soldier can be taught and made to swallow one creosote pill a day, it surely is possible to educate the British soldier to drop one or more tablets into his water-bottle daily. Whether he does it or not—the risks attaching to its omission are plain—it is the duty of the State to give him the opportunity.

Faithfully yours,

R. H. FIRTH,

Lieutenant-Colonel.

May 26th, 1906.

HAMMER TOE AND HALLUX VALGUS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The article on "Hammer Toe and Hallux Valgus," in your issue for February, 1906, will doubtless cause confusion in the minds of those who endeavour to diagnose their cases in conformity with the "Nomenclature of Diseases." In this book (p. 241) "Hallux Valgus, Hallux Varus, and Hammer Toe," are laid down as "deformities of the great toe," and the terms therefore should not be applied to deformities of other toes. Bearing this in mind, I have always described "Hammer Toe" to be a stiff, straight, great toe, which cannot be flexed upwards or downwards, and which causes recruits, when told to kneel, to go down with a thud (often sufficient to break the skin on bare boards) and prevents them springing up from their knees without the use of their hands. The deformity resembles the straight head of an ordinary hammer, and in one case, was the result of gonorrhœal rheumatism, but is usually, I believe, the result of *short*, broad boots. Recruits with this deformity well marked should be rejected; they cannot march long distances without much pain, though, as a rule, when fully developed, the deformity does not cause any pain.

The deformities of the second toe, so well described in the article, I have diagnosed as follows: (1) Flexion of second toe; (2) great toe overlapping second toe; (3) second toe overlapping great toe; the two last are accompanied with well-marked deformity of great toe (hallux valgus).

These deformities are the result of wearing narrow boots with *pointed* toes. Recruits presenting themselves for medical inspection with these deformities marked should be sent, if otherwise fit, to have the second toe (the chief cause of trouble when long marches are the order of the day, though not of necessity always a trouble) removed before they are passed for the Service.

Bedford,
April 24th, 1906.

Yours very truly,
G. F. POYNTER,
Lieutenant-Colonel (R.P.).

DEAR COLONEL BRUCE,—I thank you much for the two letters you have sent me since your return, and for the opportunity you have given me of re-considering my letter to you for publication.

It seems to me you have missed the point of my letter. In the Service our orders are to diagnose cases in conformity with the "Nomenclature of Diseases," *not* in conformity with text-books on Surgery and Medicine, the authors of which are not bound down as we are by orders, and in consequence uniformity to the "Nomenclature" is not perhaps as necessary for them as for those who wear uniform. It was to correct this error that I took the liberty of writing as I did about Captain Graham's paper; for it seems a pity a good descriptive name such as "hammer toe," which in the "Nomenclature" is applied to a fixed, *straight, hammer-headed* great toe, should be misapplied to an altogether different deformity of the second toe without a protest. This deformity of the second toe is really a *fixed flexion* of the second phalanx on the metacarpal phalanx (as it is impossible in severe cases to extend it), and the man walks, as Graham says, on the top of the second toe.

I quite agree with you as regards the text-books, and I fancy the majority of surgeons would also look upon the deformity of the second toe as hammer toe; but I think the "Nomenclature" is nearer the mark in the matter of diagnosis.

Do just as you think best about the letter. It is not a matter of much importance, except in recruiting and accuracy in filling in returns.

Bedford,
May 29th, 1906.

Yours very truly,
G. F. POYNTER.

Journal
of the
Royal Army Medical Corps.

Original Communications.

REPORTS OF THE COMMISSION APPOINTED BY THE ADMIRALTY, THE WAR OFFICE, AND THE CIVIL GOVERNMENT OF MALTA, FOR THE INVESTIGATION OF MEDITERRANEAN FEVER, UNDER THE SUPERVISION OF AN ADVISORY COMMITTEE OF THE ROYAL SOCIETY.

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(Continued from page 16.)

REPORT ON THE PREVALENCE OF MEDITERRANEAN FEVER AMONGST BRITISH TROOPS IN MALTA, 1905.

BY LIEUTENANT-COLONEL A. M. DAVIES.

Royal Army Medical Corps; Member of the Mediterranean Fever Commission.

INTRODUCTORY.

ON taking up the investigation of Mediterranean fever in its epidemiological aspects, at the beginning of June, 1905, after consideration of the various lines on which such an enquiry might be best carried out, I became convinced that the most profitable course to adopt would be to devote the greater part of the time at my disposal to the study of the disease as it manifested itself amongst the British troops. Dr. R. W. Johnstone having made a general survey of the circumstances in regard to the whole population, civil, naval and military, up to the time of writing in the previous year, it seemed that a more detailed consideration of one branch of the

subject—even though in numerical importance only a small one—might lead to useful results. I was the more inclined to take this course for two reasons: first, Dr. Johnstone had made such a comprehensive survey of the “sanitary circumstances and prevalence of Mediterranean fever” in the previous year, that there was no need for another enquirer to go over the same ground a few months later; and, secondly, the fact that, in regard to the military population, the statistical data—which are the foundations of an epidemiological enquiry—are to be relied on almost implicitly; while in regard to the population of Malta generally, our knowledge of the actual distribution of the disease, both in place and time, is at present so very imperfect, that the difficulties in the way of discovering the causative factors are extreme. Dr. Johnstone has mentioned this in his Report. The notification of Mediterranean fever throughout the population generally is extremely inaccurate, “only severe cases are notified, and not always these.” Now, whether in regard to differences of prevalence in different *places*, or variation in incidence at different *times*, unless there is good ground for trusting to the accuracy of the records of prevalence (*i.e.*, the notifications), the labour expended on enquiring into apparent outbreaks may be entirely thrown away.

The military population concerned is approximately 9,000; if every case of Mediterranean fever occurring in this population during even a single season were accurately recorded as to time and place of onset, and as to all the surrounding circumstances that could be regarded as bearing on the problem, a body of facts ought to be forthcoming that would at any rate make some addition to our knowledge of the causation of the disease; if not of the actual cause, at least of the conditions favouring the effectual operation of the cause. There seemed to be every likelihood, from the behaviour of the epidemic in May, that a large number of cases would occur amongst the troops during the hot season; and that the amount of material for investigation would be large enough to make it justifiable to limit the enquiry to this particular line. From January 1st until September 30th, 1905, there occurred 487 admissions for Mediterranean fever from among the British troops, and it is to the study of this epidemic that I have chiefly given attention.

Three principal lines of investigation presented themselves: (1) It appeared to be necessary to make a detailed sanitary survey of the actual conditions under which the troops are living in the various barracks in the Maltese Command: I accordingly visited

repeatedly every individual barrack and examined into its situation, construction, water supply and drainage, as well as any other matters that seemed to need investigation. In the present state of our knowledge, or want of knowledge, as to the causation of Mediterranean fever, it did not seem allowable to neglect any point of general sanitary importance, even though its connection with the prevalence of this disease did not seem to be obvious. It does not, however, appear necessary to encumber this report with all the detailed results of this investigation, referring in many instances to somewhat minute points of sanitary engineering practice or military administrative procedure; a brief summary only of the more important points is set forth in Section I., the details forming a separate Report presented to the Director-General, Army Medical Services.

(2) Concurrently with this the course of the epidemic was noted, and as far as possible enquired into at the time, and on the spot, week by week; the intention being to record, as accurately as might be, the actual incidence of the disease in the various barracks and in the various regiments. As far as I have been able to ascertain, it has hitherto been the practice to allocate the cases of Mediterranean fever to the barracks from which they have been admitted; the object of this part of the special enquiry has been to trace the origin of these cases with greater exactness, ascertaining the movements of the patient previous to admission to hospital, and endeavouring to locate not merely the barrack, but the room, which he had been occupying for some time before admission. In this way it was hoped that some facts would be ascertained that would serve as indications as to the cause, or rather the mode of spread, of the disease. These results are summarised in Section II. of this Report.

(3) As another means to the same end, the attempt was made to interview personally every Mediterranean fever patient, and elicit all the information procurable as to his habits, occupations and so on, previous to being taken ill. Unfortunately, some patients were too ill to be questioned, some were invalided before I was able to visit them; so that, from one cause or another, not more than 187 were actually interviewed. I much regret that I was not able to carry this part of the enquiry further.

The information obtained by these three lines of enquiry is summarised in Section III., in which an attempt is made to correlate the various facts, and ascertain what relation exists, if any, between Mediterranean fever prevalence and this or that

sanitary condition. The conclusions arrived at, and certain recommendations submitted, are set down in Section IV.

Incubation Period.—A great difficulty, that has been experienced by all enquirers into the epidemiology of Mediterranean fever, arises from the uncertainty that exists as to the length of the incubation period. Hughes, from his own experience and from a study of the literature of the subject up to the time of writing (1897), considered that it might be "as short as three days in some cases. Probably three to ten or fifteen days is near the mark in cases where the first febrile onset is noted." Dr. Johnstone states that "the general impression amongst Maltese medical men seems to be that the usual incubation period is not more than eight or ten days." In five laboratory cases of human infection "in places where there was no prevalence of Mediterranean fever, and no apparent source of infection other than in relation with infective material in the laboratory," the periods were respectively five, six, eight, fifteen and sixteen days. These infections appear to have all been by inoculation; all were accidental, except the one with sixteen days' incubation, which was definite and purposeful. In the previous Reports of the Commission instances are recorded of infection by inoculation manifesting itself after five and eight days in monkeys (Gilmour), after six days in goats (Shaw), after six, ten and thirteen days in monkeys (Horrocks); in all these cases the agglutination test has been taken as the proof of infection. By the same test infection by feeding has been demonstrated in monkeys after about twenty-four to thirty-two days in several cases (Horrocks), and in one case, in a goat, apparently after twenty-one days (Horrocks). There is a sufficient agreement in these results to lead to the supposition (which is on other grounds reasonable) that with infection by inoculation the incubation period is shorter than by ingestion into the alimentary canal; with inhalation of infected dust (monkeys) the incubation period is uncertain, seventeen to thirty-one days, or less (Horrocks).

How far the period of incubation observed in animal experiments can be considered to hold good in the case of man is doubtful; the doses used in the laboratory have been enormous; and as it would be unreasonable to suppose that the quantitative element has no effect on the rapidity of development of the disease, the laboratory limits, in all probability, require to be considerably extended when the question of human infection in the ordinary way or ways has to be dealt with. As we are at present ignorant of the path of infection in man, we must assume that incubation may be as short

as about a week, and may be as long as about five weeks, according as the infection is by inoculation or by feeding. But considering the very much smaller doses of pathogenic material likely to be actually absorbed than those used experimentally in the laboratory, it seems probable that not less than a fortnight should be regarded as a minimum period, and that the maximum period should be extended up to about six weeks at least.

In the absence of any more definite guidance I have adopted a fortnight as the most likely incubation period *at the least*, and a further fortnight as *probably* needful to be allowed for incubation. That is to say, if a man moves from Barrack A to Barrack B, and subsequently develops Mediterranean fever, I consider that if his illness commences within a fortnight of his change of residence, the infection was *almost certainly* contracted at A; while if it commences within a month of the move it has *more probably* been contracted at A than at B. I have not been able to ascertain any shorter instances of incubation than the two quoted by Dr. Johnstone (Report, Part II., p. 15), of eight and eleven days respectively; and the behaviour of the epidemic in the Essex Regiment (detailed in Section II.) points to about five weeks as probably the longest usual interval between infection and onset of illness. Further observations are much needed in regard to this matter.

Diagnosis.—All cases admitted to the military hospitals in Malta, that have been returned as Mediterranean fever, have been diagnosed as such, both by their clinical features and by the results of the agglutination test; this has been invariably applied, and no case has been returned as Mediterranean fever unless the reaction has been definite and complete.

SECTION I.

The most important points in regard to the sanitary condition of the barracks in Malta may be shortly summarised under the general headings of situation, construction, water supply and drainage.

In Valletta itself, and Floriana, there are seven separate barracks, all more or less antiquated in their plan and construction.

In *Lower St. Elmo* an infantry battalion (2nd Essex Regiment until July, 1905, then 1st Lancashire Fusiliers) is accommodated in a part of the fortress that occupies the extremity of the promontory separating Marsamuscetto or Quarantine Harbour from the Grand Harbour.

The fort adjoins the sea on two sides, but, being excavated in the rock, the barracks are entirely deprived of any advantage from this proximity; while on the south they adjoin the most densely inhabited part of the city, and on the east are shut in by the more elevated part of the fort, called Upper St. Elmo. The barrack-rooms, 52 feet in length, are casemates arranged in two tiers, and are very imperfectly ventilated: they accommodate twenty-three men in each, and the cubic space is barely 600 feet per head. The drinking water supply is ample; a second quality of water is provided for ablution, not always in quite sufficient quantity; sea water is laid on for flushing purposes. The latrines are water-closets of good pattern, and have recently been fitted with new automatic flushing apparatus; the urinals are of the ordinary type, having a scanty flush of water, and being also treated with a coating of kerosene oil. The drainage has been remodelled in recent years, and is satisfactory; the soil pipes are ventilated, and accessible inspection chambers provided at junctions of the underground drains, which discharge into the Civil Government sewer.

The water supply and drainage arrangements of these barracks are in the main satisfactory; their construction is very insanitary, the ventilation bad, and the cubic space insufficient. Although it is the practice in Malta generally to issue tentage during the summer months, sufficient to allow of 25 per cent. of the troops sleeping out of the barrack-rooms, since June, 1903, Lower St. Elmo has been excepted from this privilege, for reasons which I have not been able to ascertain. These barracks are, in my opinion, more in need of this thinning-out process than any others in the whole island. The accessories are fairly satisfactory, except that one of the cook-houses adjoins a stable.

Upper St. Elmo adjoins the last-mentioned on the east, is at a higher level, and is in every way more advantageously situated, being freely exposed either to the sea or the harbour on three sides. The barracks are occupied by two companies of the Royal Garrison Artillery; but, the quarters being insufficient for their accommodation, many of the men live and sleep in tents. A lower portion, consisting of two tiers of small casemate rooms, is occupied by 96th Company Royal Garrison Artillery; the rooms, being only about 25 feet long, are not difficult to ventilate, but the cubic space allowed (440 to 536 cubic feet per head) is very small. The upper portion consists of rooms of more modern construction, and not of casemate shape; but the cubic space, about 550 cubic

feet per head, cannot be considered as sufficient. The water supply is satisfactory. The latrines are not satisfactory; the lower latrine, used by 96th Company, has recently been fitted with an automatic flush, but it is in a dark and cramped situation; the upper latrine, used by 65th Company, was in a bad state at the time of my visit, the flushing arrangement being completely out of order, and the pans full of excreta. The urinals are scantily flushed; oil has not been taken into use. The drains are generally in a satisfactory condition, accessible inspection chambers being provided where required; some points of detail need attention in regard to the drainage of the new sergeants' mess.

The barracks generally are better than Lower St. Elmo; but the continual use of tents in this very confined situation must lead to fouling of the ground.

St. James Cavalier is a small barrack, accommodating a detachment of 138 men belonging to the Royal Garrison Artillery stationed in Upper St. Elmo, at present 65th Company. It is situated in the upper part of Valletta, the barrack-rooms being casemates similar to those in Lower St. Elmo; two of the rooms are 51 feet in length, with most inadequate openings for ventilation; they are, however, authorised to accommodate thirty-two men in each, giving a cubic space of only 535 feet per head, which is quite insufficient; four other rooms are not so long, and therefore not so hard to ventilate; all the six rooms are authorised to hold more men than there is actually space to accommodate, unless the bed-cots are arranged in three rows, a practice which would be most insanitary, and is universally condemned. At least 750 cubic feet should be allowed per head; and, even with this increase, it is doubtful if No. 6 room would be reasonably fit for occupation. The drinking water supply is satisfactory, also that for ablution; but for latrine flushing it has had to be carried up by hand. Throughout the greater part of the past summer all the water supply for the latrine has had to be carried up by hand, as a company fatigue, the result being that a minimum quantity has been provided, and the condition of the latrine has been insanitary. It is absolutely necessary that water should be laid on to a latrine in a permanent barrack. With this exception the drainage arrangements are satisfactory. The situation is bad, and the construction of the barracks insanitary.

Floriana Barracks, including Salvatore Counter Guard and Notre Dame Ravelin, are occupied by a battalion of infantry, at present the 1st Royal West Kent Regiment. They are situated

on the the north side of Floriana, and within the outer line of the landward defences of Valletta, of which they form a part. The *old* portion of these barracks consists of a range of twelve casemate rooms, about 80 feet in length, each accommodating thirty men, with an allowance of from 700 to 1,203 cubic feet per head. In casemates of this length, with no window openings except at the two ends, it is impossible to secure proper ventilation. At present the barracks are not crowded, as the accommodation is sufficient for 920, and the battalion does not number more than 780. A peculiarity of these barracks lies in the circumstance that the Malta Civil General Hospital occupies the upper part of a building, on the ground floor of which are the regimental offices, stores, &c. There is no communication between the ground and upper floors, and the drainage of the hospital is quite distinct from that of the barracks, but it is most undesirable that such a building, into which infectious cases (*e.g.*, possibly cholera or plague-stricken sailors) might be admitted, should form part of a structure occupied as a British barrack.

The *New Barracks* consists of three blocks of two-storey buildings, each accommodating one company, that have only recently been completed; the rooms are well arranged, according to modern principles, each holding twenty-six men, with an allowance of 755 cubic feet per head.

The rooms in *Salvatore Counter Guard* are small casemates with no through ventilation at all, and with a scarp wall distant only 12 yards from the front of the rooms; the movement of air must be very limited at any time, and adequate ventilation impossible; in spite of this, the allowance of cubic space is less than 600 feet per head; neither have the men been thinned out at night during the hot weather.

Notre Dame Ravelin consists of a range of sixteen small rooms on the ground floor, accommodating five men in each, with an allowance of 900 cubic feet per head; and of seven huts, each for eighteen men, with 600 cubic feet per head. These are all well ventilated and of satisfactory construction. The huts stand on a concrete platform and are slightly raised from the ground.

There is a good supply of No. 1 water for drinking and No. 2 water for ablution purposes; for flushing the supply (No. 2) is sometimes defective in the Old Barracks; a larger tank and separate supply for the latrine seem to be required. The drainage of all these barracks is of modern construction and, in the main, satisfactory. One of the latrines in the New Barracks was in bad order

at the time of my visit, partly owing to a structural defect; and in several places the internal surface of the drains is uneven, leading to obstruction, or retardation of flow; gully gratings are in some places deficient. The urinals are treated with oil, and also flushed with water.

Of these barracks it may be said that the New Blocks and Notre Dame Ravelin are satisfactory, but that the Old Barracks and Salvatore Counter Guard are bad and incapable of being made suitable for accommodating troops. Great complaints are made of the extensive fouling of the ground in the neighbourhood of these barracks, where a large number of Maltese labourers are employed road-making, &c. The troops have no control over these people, and the civil authorities appear to be powerless in the matter.

St. Francis Barracks, Floriana, are a small range of barracks of very old type, partly on one, partly in two stories, occupied by a company of Royal Engineers. Nos. 3 and 4 rooms on the ground floor are large apartments, 66 by 29 feet, authorised to accommodate forty-five men in each; the ceiling is arched, and, if the height be reckoned as 26 feet, the cubic space per head amounts to 1,079 cubic feet, as shown in the Barrack Return; but if 12 feet of height only be reckoned (according to the general rules for calculating cubic space), the amount per head is only 500 feet. The means of ventilation are insufficient. Nos. 6 and 7 are large rooms on the upper floor, fairly well provided with windows and ventilating openings, but difficult to ventilate, on account of their excessive width—40 feet. These are very unsatisfactory barracks; if they are to continue to be occupied, a cubic space of 750 feet should be allowed, and no greater height than 12 feet should be reckoned as available for ventilation purposes. The water supply is satisfactory. The latrine and urinal are of a very old pattern, and require reconstruction; the drainage is modern and in good order.

Marsamuscetto Barracks, occupied by the Army Ordnance Corps, consist of two rooms on the ground floor, each accommodating forty-one men; the rooms are arched casemates, 72 feet in length, having windows only at one end: adequate ventilation is impossible, yet the effective cubic space (reckoning a height of 12 feet) is only 540 feet per head. The number of actual occupants is at present less than half the allotted number, so that there is no overcrowding; but the building is unsatisfactory. The latrine is within 20 feet of the cook-house; it is flushed only twice a day; a third flush at least is required. The urinal is intermittently and scantily flushed with water. The drainage is in good order.

The *Old Laboratory Barracks*, occupied by Army Service Corps, Army Pay Corps, Military Foot Police and Garrison Staff, consist of four rooms at an upper level, and two at a lower level; the upper ones are arched casemates, with very inadequate ventilation; the lower ones are in a very cramped and confined situation. The latrine is exceedingly cramped, dark, and ill-ventilated. The barracks are said to be condemned. They are incapable of being made really satisfactory from a sanitary point of view. The water supply and drainage are inadequate.

Manoel Fort and Hutments together accommodate an infantry battalion; up to the beginning of June they were occupied by the 1st Rifle Brigade, since then by two companies of the Lancashire Fusiliers. The situation, on a small island in Marsamuscetto Harbour, is favourable, with free air-space all round. Seven of the barrack-rooms in the fort are casemates, about 32 feet in length, each accommodating nine men, with 600 cubic feet per head; being small rooms, their ventilation would not be unsatisfactory, but that the blank wall of the chapel and officers' quarters is only a few feet distant from the front of the rooms, and materially interferes with the free passage of air. Three other rooms, accommodating thirty-six men in all, are free from this disadvantage. The hutments consist of twenty-eight huts, each accommodating eighteen men; they are well raised from the ground on pillars; the surface beneath is cemented, clean and dry, and they are not overcrowded. The water supply is satisfactory; No. 1 water is used for drinking and washing in the hutments; in the fort, No. 2 water is collected in tanks in the rainy season, and used for ablution and flushing purposes. The latrines are all on the dry earth system; a double set of buckets is provided, but the excreta are removed only once a day, in the early morning. The water drainage system takes urine and ablution water, and discharges direct into Marsamuscetto Harbour; it is of modern construction and satisfactory. Except for the retention of the dry earth system, these barracks are in a good sanitary condition. A connection should be made with the Civil Government sewer as soon as possible.

Tigne Barracks, occupied by three companies of Royal Garrison Artillery, consist of the old fort, two new blocks of quarters, and fifteen huts; in addition are married quarters, offices, institutes, &c., all of modern construction. The situation is excellent, having the open sea to the north and east, and Marsamuscetto Harbour to the south. The fort contains only a few small rooms; one on the upper floor is well ventilated; seven on the ground floor are at a lower

level surrounded by the fort wall, and badly ventilated ; only two are in present occupation, and all (it is said) will be evacuated shortly. The two new blocks, each accommodating 100 men, are two stories in height, and satisfactory in every way ; except that the urine tubs have to be carried *through* the rooms on the upper floor from the verandah at back to the staircase in front, thereby leading to fouling of the floor with possibly infective material. The huts accommodate eighteen men in each, are well raised off the ground, which is concreted and easily kept clean, and are not overcrowded. In the summer 25 per cent. of the men sleep in tents ; in the 99th Company no trestles or bed-boards were supplied, and the men's mattresses were placed on the ground ; this should not be allowed.

At present, No. 1 water is used for all purposes, 20 gallons per head being allowed for everything. Until recently the latrines were on the dry earth system ; now that a water latrine has been erected, it will probably be necessary to draw on the rain-water tank beneath the barrack square ; but it would be better to lay on a supply of flushing water. In the fort the ablution water and urinals drain into a system that eventually enters the open sea ; a dry earth latrine remains in use, which is regrettable. For the rest of the barracks an excellent modern drainage system has just been completed, discharging into the Civil Government sewer. Two dry earth latrines still remain in the western part of the barracks, one being for the use of the school ; the other is no longer required ; this should be closed, and a water latrine provided for school use. A large new latrine has just been opened to the north-east of the barrack square, containing thirty-four seats ; this is flushed three times daily, at present with No. 1 water. It is an important question affecting several barracks, whether this No. 1 water, the supply of which is very limited, should be used for flushing purposes. There is great danger of the quantity being restricted, leading to an offensive and insanitary condition of the latrines ; it is also very doubtful whether its use for this purpose is justifiable under the circumstances obtaining in Malta. I am very strongly of opinion that a supply of flushing water should be laid on to all latrines, and used in great abundance ; and that No. 1 water should only be used (as a rule) for drinking and cooking purposes. In the present case the greatest care should be taken to prevent this new latrine, connected with a new system of drainage, from degenerating into the filthy and dangerous state that so many of the latrines in Malta have been allowed to get into, principally

through deficiency of a proper supply of water, in some instances unavoidable, in other instances the result of neglect.

The urinals are treated with paraffin oil and lampblack, and water flushing is used as well. The new urinal contains twenty-six stalls, the authorised allowance (4 per cent.) for the number of troops occupying the barracks. It is extremely inconvenient to collect all the urinals together in one place; and when so many stalls are provided in one range most of them are not used; not more than six or eight stalls are ever required in one range; the rest are useless, and lead to a great waste of water.

Except for the minor points of detail, these barracks are satisfactory in every way as regards situation, construction, water supply, and drainage; but care must be taken in regard to the matter just mentioned, in order to maintain this satisfactory condition; if water is stinted for flushing purposes, the state of things will be very different.

To the south-east of the Grand Harbour, and elevated a considerable height above the sea-level, lie the Verdala Barracks, a chain of fortifications called the Cottonera Lines, and at the harbour's mouth Fort Ricasoli.

Verdala Barracks, occupied by an infantry battalion (2nd Hants), consists of sixty-six small casemate rooms, each about 25 feet in length, and accommodating ten men; they are disposed on two floors and in two rows; being small rooms, and in a fairly airy situation, their ventilation presents little difficulty; the cubic space allowed is, however, only 515 feet per head, which is not sufficient; the accoutrement shelves are fixed to the walls in a continuous line, and the bed-cots are only 12 inches apart from each other. Drinking water is laid on, and the supply is ample; for washing No. 2 water is pumped up by regimental fatigue; until July, 1905, all the water required for flushing purposes was also similarly pumped up; now, however, salt water is laid on for this purpose, but the supply at the time of my visits was uncertain, and frequently No. 2 water had to be pumped up, regimentally, as before. The regimental latrine is situated rather near the cook-house; it is of Jennings' continuous pipe pattern, and until recently was only flushed twice a day; it is now flushed three times daily, at 9.0, 2.0 and 5.0, and this is hardly sufficient. When a proper supply of salt water for flushing is available, it should be done four times a day. The urinal has fourteen stalls, aggregated together, many of them being never used; both water flushing and oil application have been practised, the former ineffectually; the stone

floor is very uneven and requires putting in order. The underground drainage is modern and, on the whole, satisfactory. Some additional ventilation to the system would be advisable, and provision for automatic flushing instead of the present inefficient method of flushing by hand with barrels of salt water when it is available. The sanitation of these barracks has been well looked after, under circumstances of considerable difficulty.

The quarters which together make up the *Cottonera Lines* are St. Clement's Bastion, Zeitun Gate, Polverista, St. John's and St. Paul's Bastions, Cuvre Porte, Vittoriosa, Fort Salvatore, Zabbar Gate and Notre Dame; accommodating in all about 780 men, that is, an infantry battalion. In the early part of 1905 they were occupied by the Royal Sussex, and then by the Lancashire Fusiliers; since the departure of this regiment for Lower St. Elmo they have been mostly vacant, except for detachments of the Hants Regiment in Polverista and St. Clement's. All of the barracks are old and defective in many ways; proper ventilation is very difficult; if their occupation is continued, at least 750 cubic feet per head should be allowed, reckoning only a height of 12 feet as of any value for ventilation purposes. The small rooms at Zeitun Gate are fairly sanitary, but the larger ones, Nos. 5, 6 and 7, measuring about 32 by 20 feet, without any windows except in the front wall, are impossible to ventilate satisfactorily. The rooms in Polverista, which are arched casemates, 33 feet long, accommodating fourteen men in each, are also very inadequately ventilated. The small rooms in St. John's and St. Paul's, although inconvenient, are not difficult to ventilate. At Cuvre Porte, No. 11 room has no window at all, and is unfit for occupation. Vittoriosa has three large rooms, each accommodating thirty-four men, which are airy and well lighted, though a proper cross ventilation is not possible. The three large rooms at Fort Salvatore, each measuring about 80 by 20 feet, cannot be adequately ventilated by the very small openings that at present exist. At Zabbar Gate the two large rooms, though light and airy in appearance, are very hard to ventilate, on account of their great width—36 feet. Notre Dame, consisting of eight small rooms, is fairly satisfactory.

The water supply of these small barracks is a matter of some difficulty, and in connection with the latrine arrangements requires more attention than has hitherto been given to it. No. 1 water for drinking is laid on, and is sufficient and always available. For washing purposes and for flushing latrines and drains No. 2

(collected rain-water) has, until last July, had to be pumped up by regimental fatigues; at Polverista the pump has broken down several times (twice during the time I was making my visits to the barracks in July and August); the labour of working this pump appears to be excessive. I was informed that a fatigue of nine men, working six hours a day, was required. On three occasions I found the latrine empty of water, but fouled with excreta; this appeared to be a not uncommon occurrence. It has been the same with the other outlying barracks. Salt-water flushing is in course of being provided, but so far the supply has been uncertain. Until an ample supply of water is available for adequately flushing the latrines—at least three times a day—and for keeping the extensive system of drains in good order, these barracks are not fit for occupation.

The drainage generally is modern and satisfactory in construction. There has been considerable complaint of bad smells in front of Polverista; the drains are properly constructed, but more water is required for flushing the verandah drain and down pipe leading into the collecting drain below.

Fort Ricasoli lies at the mouth of the Grand Harbour, on its eastern side, in an ideal situation; it is open to the Mediterranean and the harbour in three directions, and has the open country to the east, with no villages near. An ample supply of drinking water is laid on, used also for ablution purposes, and salt water is drawn from the sea for drain flushing, by a pump independent of any other supply. The drainage passes direct into the sea, by three independent systems of drains, which have been laid down within the last few years according to modern principles, and which are in good order. Some additional provision of fresh air inlets would, in my opinion, be desirable. The latrines and urinals are well kept, a mixture of tar and kerosene oil being used for the latter. One latrine was found to be without any water (but full of excreta) on one occasion, owing (so I was informed) to choking of the branch supply pipe. Even under the quite exceptionally favourable conditions as regards water supply at Ricasoli, strict supervision and watchfulness are necessary.

The barrack-rooms are mostly large and lofty, having plenty of window space on one side (facing the square), but no openings on the other (which is the outside of the fort); five such rooms are each over 100 feet in length by 22 feet wide, accommodating between fifty and sixty men in each. Being about 23 feet in height, the cubic space per head (about 1,100 feet) is large, but it is not

all available for ventilation purposes, not more than 12 feet of height being really effective; on account of this height and the width of the rooms, it is difficult to get a free change of air. The bed-cots are placed very close together. No. 1 room, 80 by 22 feet, has two windows only on one side, and a doorway at one end; there are no windows on the other side or at the far end, which is quite unventilated.

The actual barrack accommodation is for 480; but three companies Royal Garrison Artillery are normally stationed here, with a strength of about 700; about 120 are quartered in outlying forts, and about 150 in tents pitched in the barrack square, occupied all the year round. In the summer 25 per cent. extra tent accommodation is drawn. Although the construction of the barracks is not sanitarily satisfactory, the general good hygienic conditions of Ricasoli, and its fine airy situation, should make it a healthy station.

Outlying forts on the eastern side: Small bodies of men are accommodated in several small forts in this direction. In every case the cubic space is sufficient, though, from military exigencies, ventilation is restricted. Drinking-water is laid on to all the forts; but for some months during the past summer this pipe supply has been cut off, and the water has been carried out to the fort in barrels. The drainage arrangements are generally satisfactory, as regards slop water and urine. Dry earth latrines are in use. These require to be more carefully supervised, and the removal should be more frequent.

The barracks hitherto mentioned have been, in the main, old buildings, dating from a pre-sanitary era, though added to from time to time, and with drainage and water supply modernised more or less efficiently. On the north side of the island are two extensive ranges of barracks, one of which, St. George's, was built in 1860, and has since been added to, and the other, St. Andrew's, has only been completed in the year 1905. Each of these accommodates an infantry battalion.

St. George's Barracks, occupied by the Royal Dublin Fusiliers, consist principally of single-storey blocks of small barrack-rooms, accommodating thirteen men in each, with 605 cubic feet per head; these are of good construction, and very fairly well ventilated; the accoutrement shelves are fixed to the walls in a continuous line, and the bed-cots are only 12 inches apart from each other, which causes what may be called an artificial overcrowding at night. There are two new double-storey blocks of quite modern design, airy, well ventilated and well arranged; the rooms accommodate

sixteen or eighteen men in each, with an allowance of 750 cubic feet per head. A defect in the arrangements is that the urine tubs have to be carried through the rooms on the upper floor, from the back to the front (as at Tigne), thereby leading to fouling of the floor with urine, which is most undesirable.

No. 1 water is laid on for drinking and also for washing, the supply being quite ample; it is also laid on to the married quarters for flushing purposes as well. In the barracks sea water is pumped up for latrine and drain flushing, but owing to defects in the pumping arrangements, the quantity of water provided has been insufficient, and the latrines have not been properly cared for. The drainage is of modern construction throughout and is well looked after; the latrines are flushed three times a day if water is available; the urinals are in good order, a mixture of lampblack and kerosene being applied. There are several minor defects which might be easily rectified. One frequent source of drain obstruction in Malta is the readiness with which sand and gravel are blown into and washed into and through gullies; in these barracks, which are well exposed to the wind, this occurs to a considerable extent, and causes some difficulty in keeping the drains clear; raised parapets, to keep out surface washings, and deep traps might be supplied in some places with advantage.

St. Andrew's Barracks were only completed in the early part of 1905, and were taken over by the 1st Battalion Rifle Brigade in June. They consist of nine double-storied company blocks, the rooms accommodating fourteen men in each, with a cubic space of 800 feet per head. They are satisfactory in every detail, except for the necessity of carrying urine tubs through the rooms on the upper floors. The water supply is No. 1 for all purposes. The drainage is satisfactory in its main features, but there are several points of detail that require attention, such as the provision of accessible manhole covers (instead of cemented slabs), easing off of right-angled junctions, &c.

Pembroke Camp is a musketry camp near St. Andrew's Barracks, occupied by parties of men from various regiments in succession throughout the whole year, as many as 800 or 900 being sometimes under canvas at once. Its sanitary condition is very unsatisfactory. The ground is rocky and uneven, and difficult to keep clean; the sites of the tents are never, or hardly ever, changed. There is one dry earth latrine of twenty-six seats for the whole camp; this is not sufficient accommodation for the numbers that are frequently present; the latrine seats are badly constructed, being too high (or

the pails placed too low); fouling of the ground with urine results. The pails are removed only once a day, between 4 and 5 a.m., the result being that for the greater part of the twenty-four hours the air of the camp is fouled by excretal emanations; flies are also attracted in great numbers. The woodwork of the latrine is in bad repair. The urinal consists of a plain marble slab like a native convenience; it is flushed with water and no oil has been applied. At the north-west end of the camp is a cesspit, connected with the officers' w.c., apparently unventilated, and in close proximity to the water tank and officers' cook-house. A water drainage system is now being carried out, and this cesspit should be removed.

Pembroke Camp is in a very bad sanitary state, not due to any want of care on the part of the camp authorities, but on account of obvious defects of design and construction in what may be called minor details. A small *permanent* sanitary staff should be provided to keep the camp in as sanitary a condition as may be possible, and lessen the difficulties resulting from the constantly shifting character of the population.

In regard to the *outlying forts* in the Western District the same remarks apply as to those in the Eastern, except that No. 1 water is laid on in each case, and is ample in quantity. The dry earth system is in use, and is fairly satisfactory, except at Maddalena, where the accommodation is insufficient, there being only two latrine seats. Everywhere removal only takes place once a day, which is not enough. A modern drainage system for slop water, &c., has been laid down in each case.

Imtarfa Barracks consist of four large blocks, accommodating 233 in each, and four smaller blocks, accommodating 110 in each, all of two stories; the rooms are constructed for either sixteen, eighteen, or twenty men, with a space of 750 cubic feet per head. They are excellent barrack-rooms in every way, well built, and with every convenience. No. 1 water is laid on for drinking and washing; rain-water is collected in underground tanks, and pumped up regimentally for cleaning and flushing purposes. The latrines have hitherto been on the dry earth system, but a water carriage system will be introduced very shortly. A complete system of drainage has been constructed, to which the latrines can be readily connected up. The dry earth latrines were in a satisfactory condition at the times of my visits, but I was informed that this had not been the case earlier in the summer, and that it had been found necessary to employ regimental fatigues to apply the dry earth thoroughly. It is difficult to get the dry earth system properly

carried out anywhere (though principally a matter of regimental discipline), but the difficulty is much increased in the case of a body of men who have been accustomed to the use of water latrines, that require no attention on the part of the individual. In the present case a rather considerable prevalence of enteric fever has been due, in all probability, to faulty carrying out of the dry earth method at Imtarfa. The latrines are emptied by contract once only in the twenty-four hours, about 2 a.m.; during the greater part of the day, therefore, they are full of excreta, and the air of the barracks proportionately fouled. Flies are quite a plague in some parts of the lines, a fact which is always significant and generally of ill omen. The urinals are treated with a mixture of colza oil and tar; this has acted most satisfactorily, applied once a week. The urinals here were in a better state than any others in Malta at the times of my visits. The underground drainage system is satisfactory on the whole; at one or two places the fall appeared to be hardly sufficient, *e.g.*, at the north-west corner of the canteen a considerable amount of deposit was found; there was also a good deal of deposit in the main collecting drain at the east end of the barracks, north of the junction with No. 1 cook-house drain; in both places this has, I understand, occurred before, more than once. Additional flushing is required, and careful supervision to see that no stoppage takes place.

Some surface drains which take the washings of the verandahs of married quarters lead into the foul drainage system, passing through a gully trap to cut off the foul air. Such is the case in M, N, O, and P Blocks, Married Quarters. But the verandahs of these blocks are not habitually, and probably very seldom, if ever, washed down with water; consequently, in dry weather no water gets into this gully, or at least not enough to provide an efficient seal. The trap was unsealed at the time of my visit, in the case of each of the above-mentioned blocks, the trap being almost dry, and choked with sand, which at the bottom was moist and foul-smelling. These traps require to be seen to, and filled with water periodically. The sewage is at present conveyed to a kind of septic tank, the effluent from which is applied to land in the Kleir Wied, to the north of the barracks. This method of disposal is quite inoffensive.

The situation of these barracks is all that could be desired. They stand on an isolated hill, some 600 feet above the sea, exposed to the fresh air on all sides, and with no insanitary dwellings near at hand. The barracks are well constructed and sanitary. With

a good water supply, and a proper system of sewerage and refuse removal, the troops should be free from all epidemic disease. It has, however, unhappily been the case that there has been a good deal of sickness this past year, due to preventable causes.

At Ghain Tuffieha and Mellieha, in the extreme west of the island, are camps used by the troops, chiefly during the winter season ; also at Ghain Tuffieha is the standing camp of the Mounted Infantry, the permanent strength of which averages 250 to 300 men throughout the year. The situation of each of these camps is quite satisfactory. In each case there is a good and ample supply of drinking water laid on ; also a drainage system on modern principles. At Mellieha the latrines are water latrines, and the whole of the drainage is conducted to a small septic tank, the effluent from which passes into the open sea. At Ghain Tuffieha, up to the present, the dry earth system has been in use. The drains carry off drainage from cook-house, stables, urinals, &c., to a septic tank, hermetically sealed up with great care, the effluent from which passes into the sea. When water latrines have been provided, in place of the dry earth buckets, and connected with the existing drains, this camp ought to be extremely healthy, provided the ordinary rules of camp sanitation are strictly carried out, and the drains carefully looked after.

Fort Chambray, Gozo, is an old fortress of the Knights, in which there is accommodation for (nominally) 400 troops. The barrack-rooms, four on the ground floor and four on the upper floor, are 100 by 20 feet, with good windows at each end, but no openings, except a doorway, at the sides. They are therefore very difficult to ventilate. The accoutrement shelves are fixed to the walls, touching each other, and the bed-cots are very close together ; but as only one company is at present in occupation, there is no overcrowding. Drinking water of good quality is laid on from the public supply. Collected rain-water is pumped up regimentally for washing and flushing purposes. The drainage system is partly modern and partly old, but is now nearly all remodelled. On the whole it is satisfactory. A foul catch-pit outside the married men's latrine, and a series of deeply-sunk silt traps in rear of the married quarters require certain obvious and easily practicable alterations. The latrines are on the dry earth system, with removal once a day only. Urinals are treated with lampblack and oil. These barracks are admirably situated for health, and are satisfactory in all important particulars.

HOSPITALS.

Valletta Military Hospital contains 232 beds, and also has quarters for sixty-five non-commissioned officers and men of the Royal Army Medical Corps. The buildings are ancient, and not well adapted for hospital purposes according to modern requirements. The situation is unfavourable, as, although it borders on the Grand Harbour to the east, on the west and south it is closely surrounded by crowded dwellings of the poorer class; moreover, the principal wards are deprived of the beneficial effects of the cool north-west wind by reason of the lofty houses built on higher ground in that direction. The wards are lofty, and, on account of the thickness of the walls, cool in summer and warm in winter.

The principal feature in the hospital is the famous "Long Ward," probably the longest room in the world, being 503 feet in internal length, without any break in the continuity of the ceiling or east wall. Its width is 35 feet, and its height $32\frac{1}{2}$ feet. Near the middle a transept is given off to the west, of nearly equal width and height, and about 100 feet in length, forming part of the same chamber. To facilitate administration the whole apartment is divided by partitions, 10 feet high, into northern, southern, central, and western portions (20A, 20B, 20, and 20C); but from a sanitary point of view it is all one chamber. In 20A are accommodated fifty patients, chiefly Mediterranean and enteric fevers; in 20B are sixty, venereal and slight cases; in 20 and 20C are slight fever cases. The cubic space is very large, 4,000 cubic feet per head, reckoning the whole height of $32\frac{1}{2}$ feet; if the height be taken as 12 feet, it is over 1,500 cubic feet per head. These amounts appear to be ample. There are difficulties in ventilation, however, in spite of this ample cubic space, which, indeed, is of no advantage if it interferes with the free access of external, and exit of internal air. It is obviously more difficult to change the air of a room 30 feet wide than that of a room 10 feet wide, the amount of window space being the same in each case. In this instance the width is 35 feet, and the window space is not large. There are very few windows in the lower part of the walls. In the upper part there are plenty; but there is reason to believe that they have not been opened, and kept open, so freely as would have been desirable, and that consequently the ventilation of this large apartment has not been satisfactory. Notwithstanding its coolness and spaciousness, the difficulties in maintaining purity of the air,

and the impossibility of isolating the patients, render this "Long Ward" an undesirable place in which to treat the sick, although at first sight it appears to be very well adapted to the purpose. The wards on the upper floor are of moderate size and well ventilated. The flooring of the wards is of cement concrete, having a smooth, impermeable surface that is easy to keep clean.

The water supply is good and ample for all purposes. The drainage system has been entirely reconstructed within the last few years, and is in accordance with modern requirements; the drains discharge into the civil sewers at three different points, being cut off by proper disconnecting arrangements. Accessible inspection chambers are provided freely. A few points of detail in construction require attention, as, *e.g.*, a proper grease trap for the cook-house; abolition of the large foul catch-pit near south-east corner of Lower Squate. Other important requirements are (1) a new latrine for 20B Ward, the present one being in bad repair; (2) concreting the rough floor of latrine and urinal for No. 37 Ward.

The Families Hospital, though in rather a cramped situation, is fairly satisfactory.

The Royal Army Medical Corps barrack-room is a large apartment, 96 by 31 feet, with an annexe on one side, 28 by 17½ feet. It is well lighted and airy in appearance, but on account of the great width and absence of cross ventilation it is difficult to secure a proper purity of the air.

Cottonera Hospital is a modern building of good general design, and is in an excellent, airy, and healthy situation, standing in its own grounds, at a considerable elevation. It has four large wards, 128 by 26 feet, of thirty-two beds each, and several smaller ones, 156 patients being accommodated in all. The wards are well designed, well lighted, and well ventilated. The ward annexes are capable of improvement. The principal sanitary defect in this hospital lies in the material of the ward floors, which are made of a soft and easily friable porous white stone; it wears away unevenly into holes, which are difficult to keep clean. The operation of ward-sweeping twice a day fills the air of the ward with fine dust, which is afterwards deposited on the patients, on their beds, and on any articles of food that may be exposed; a good deal of it must be inhaled. The floor spaces between the beds have been treated with some hardening preparation that makes the stone impermeable, but the main part of the floor in the centre has not been so treated. The provision

of a smooth, impermeable floor, as at Valletta, is an urgent necessity. Water supply and drainage are quite satisfactory.

Forrest Hospital (thirty-one beds) is a hired house, not designed for a hospital, but in as satisfactory a condition as can be expected. The water supply and drainage arrangements are in good order. A considerable number of the patients (twenty to thirty) are treated in tents all the year round (owing to want of sufficient accommodation), which greatly adds to the difficulties of maintaining a good sanitary condition of the hospital and its accessories.

Imtarfa Hospital (forty-two beds) is a new building constructed in accordance with modern principles, and is in every respect satisfactory.

Citta Vecchia Sanitarium (eighty beds) is an old palace of the Knights, with large airy rooms, and well fitted for treating convalescent cases. The water supply and drainage are satisfactory.

Gozo Hospital contains fifteen beds, and is satisfactory in its situation and construction, water supply and drainage arrangements.

MARRIED QUARTERS.

There is accommodation for about 650 married families in the Maltese garrison, and in the majority of instances this accommodation is remarkably good. In this category are to be placed the two new blocks at Floriana, known as Misida Bastion (44 quarters), the new block in St. Francis Ravelin (6), the four new blocks at Tigne (65), D Block, St. George's (10), all St. Andrew's (36), Verdala New Block (24), Ricasoli new blocks (18), and all Imtarfa (55). These quarters are all excellent in every way, airy, and well ventilated, the water supply laid on, and good water-closets of modern wash-down pattern provided; in nearly every case also the situation is good; they are some of the most agreeable residences in the island. There are certain minor defects in sanitary detail that require attention, but nothing to interfere with their permanent usefulness, healthiness, or convenience.

The largest block of married quarters in Valletta is the building known as the Camerata, facing the Valletta Military Hospital; this accommodates ninety-two families, and is generally nearly full. It is an old building of six stories, and is comparable to a block of artisans' dwellings in London. Being situated in the middle of the town, it is not so fresh and airy as other quarters, and some of the rooms are without direct communication with the external air. New closets of first-rate pattern have been recently supplied on each

floor, and the building is kept in admirably clean and good order ; so that, in spite of its being somewhat crowded, it is really quite a sanitary and satisfactory block of dwellings.

The other older quarters, such as those in Upper and Lower St. Elmo, Floriana Pavilion (14), St. Francis Ravelin (16), Fort Manoel, the old blocks at St. George's (55), the old quarters at Ricasoli (20), St. Nicholas and Gozo (21), though not so convenient, or so well off in the way of closet accommodation and water supply, are, nevertheless, in a fairly good sanitary condition.

The large block of hired quarters in Strada Magazzini, Floriana, has been put into as good a condition as is practicable in regard to water supply and sanitary arrangements ; but there are certain grave defects of construction in regard to the drainage (faulty pattern of w.c. liable to become untrapped, ill-ventilated closet chambers, inferior work in the underground drains) that prevent their being considered satisfactory quarters ; they resemble the ordinary private houses in Valletta, &c., and are not to be compared to any of the newly erected married quarters that have been just mentioned. The hired quarters at Tigne are to be placed in the same category ; those in Strada Capuccini, Floriana, are satisfactory.

There are some married quarters on the Cottonera side (Fort Salvatore (14), Vittoriosa (3), and St. Nicholas (Back) that are very undesirable residences, and, indeed, hardly fit for occupation.

On the whole, the accommodation for married families is extremely good, and, from a sanitary standpoint, very satisfactory.

(To be continued.)

THE HEALTH OF THE SOLDIER; WITH SPECIAL REFERENCE TO PREVENTABLE DISEASES.¹

BY LIEUTENANT-COLONEL H. J. BARRATT.

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THE subject I have chosen is one of the utmost importance in dealing with the welfare of the soldier, not only in relation to the circumstances under which he lives, but also the conditions under which he serves. We are well aware of the careful military training which each soldier undergoes in order to render him efficient in the performance of his military duties, but in addition to this it should be the duty of every officer and non-commissioned officer so to educate the soldier that he may understand that, in order to be efficient in the true sense of the word, he must be physically fit, and capable of carrying out the important duties assigned to him, not only during peace, but also in war. He must be taught to learn that by attention to his bodily health and well-being in the many changeable conditions under which he is liable to serve—at home, on foreign service, and on field service—he can, to a very great extent, control and limit the many evil effects due to adverse climatic or other conditions, to which he is necessarily exposed, and which have to be encountered.

The main object in view, therefore, being “physical endurance,” it must be obvious to any one that disregard of personal health, thoughtless inconsideration of the injurious effects produced by exposure to adverse and trying climatic conditions, excesses of all kinds, debauchery and drink, must so weaken and impoverish the system that it becomes practically impossible for any soldier, who is regardless of the laws that govern health, to maintain himself in that state of health and physical fitness (with a reserve of vital energy and recuperative power) which is so essential for prolonged physical endurance. Owing to the many varied dependencies of the British Empire, the conditions of service are such that a soldier may be called upon to serve under conditions varying from an arctic cold to a tropical heat: and it is apparent to every one that the state of existence in the one is totally different to the other. Here in India, to which climate my lecture specially refers, the wide variation in the daily temperature is greater than in any

¹ Lecture delivered at Meerut, India, February 27th, 1906.

other country, and it is this great variation of temperature in the twenty-four hours that is so productive of chills, which cause fever, and thus lower the vitality and resisting power of the individual, rendering him more liable to contract other more serious diseases.

Let us now consider the soldier from the time of his enlistment. It will be found that he is far more ready and apt to learn from the example of others than from precept, and it is for this very reason that the daily habits of those with whom he has been brought in contact, more especially the older soldiers, and to some extent the non-commissioned officers, appeal to him so strongly, and either guide him rightly or lead him to do wrong. If he could but be taught to learn that the old adage, *Mens sana in corpore sano*, is more applicable to him than to almost any other career in life, I have no doubt that the general efficiency and standard of health throughout the British Army would be considerably improved. It is therefore to the physical education of the troops that the attention of every officer and non-commissioned officer should be directed, to prevent rather than to cure, and to educate the young soldier to enable him to exercise his own judgment in discriminating between what is right and good for his own personal benefit, and what is thoughtless, foolish, evil and wrong, and to his own personal disadvantage and detriment. Much depends on the methods adopted to impart this necessary knowledge without making it irksome and tedious, and yet at the same time interesting, so as to impress on the young soldier how much depends on his own individual action in maintaining himself in a good state of health. Personally, I have found no difficulty in gaining their confidence and attention in the many lectures that I have delivered to them; and I firmly believe that by a systematic course of instruction, in which the aid of all officers and non-commissioned officers is of paramount importance, it is possible to direct young soldiers into the right way of thinking, so that they can see and judge for themselves, and act accordingly. Apart from these lectures, I have found it necessary to draw up a code of rules for their guidance, which could be distributed and hung up in each barrack-room, so that each man could read them at his leisure. It is called "Rules for Keeping in Health," and to most of us they may appear very simple in themselves; but it is the non-observance of these simple rules that is the cause of so much sickness throughout the British Service, and from my own experience I have found that impressing these simple facts on young

soldiers has led to most excellent results. The rules deal with ordinary indiscretions that are followed by ill-health.

"Rules for Keeping in Health.—For the protection and preservation of health in this country, it is necessary to observe certain simple rules, which are stated hereon for guidance, and it is hoped that every soldier will act up to them, and endeavour to preserve his health and keep himself in good condition.

"(1) Do not spit about in your barrack-room; the habit of spitting on the floor of a room makes it most unhealthy, and is one of the principal causes of sickness."

This is a very important rule, as many diseases are caused by the sputum, or expectoration, drying up and setting free bacteria that are infective, which are blown about like dust. The chief disease spread by this means is tuberculosis, which was at one time far more common among soldiers than it is at the present day, which improvement is due to better sanitation, improved ventilation, and isolation of affected cases. The habit is a dirty and injurious one, and could be overcome by restraint, care and cleanliness.

"(2) Do not forget to change your clothing when you come in wet with perspiration. If you sit about in wet clothing the surface of your body gets chilled, and this produces fever; and remember that one attack of fever often leads to another. For the same reason, avoid cold winds when you are hot and tired and your clothes are damp."

The necessity of observing this rule is obvious. It is a common practice for men to play games, and when the game is over and their clothes wet with perspiration, to sit on the stone steps of verandahs, or under a "punkah," and get thoroughly chilled, the consequences being headache, fever, bowel complaints, bronchitis, tonsillitis, inflammation of the liver, pleurisy, or pneumonia, and, if a malarial subject, an attack of ague. In the hot weather, more especially during the rainy season, all damp or wet clothing should be changed as soon as possible.

Within the last few years, every soldier has been provided with three silver-grey flannel shirts, instead of two as formerly, and there should be no difficulty in carrying out this rule. It would be better, however, if all men were encouraged to provide themselves with a simple flannel shirt and trousers for wear during games; they are inexpensive, and could be purchased by contract and sold at a very moderate price; this would help to ensure the clothing being changed after the game is over. I would further suggest for the

health and comfort of the soldier, that sleeping suits of light flannel should be provided at a moderate cost; this is a matter of very great importance. Nothing can be more injurious to health than sleeping in a shirt that is damp with perspiration, whereas a dry, comfortable, light flannel sleeping suit would not only be a protection to health, but enable the soldier to air and dry his shirt during the night. I should also like to mention under this heading the advisability of providing a medium merino sock, in place of the white cotton socks sometimes worn during the hot weather months. The white cotton socks soon get soiled, and are very quickly and easily worn out, so that the men are not disposed to wear them. Many men wear the thick grey worsted sock through the hot weather, and anything more uncomfortable or likely to cause tender feet cannot be imagined. Light merino socks would be more comfortable, more durable, and gladly worn.

"(3) Do not delay in reporting sick, if you are not feeling well, if you are constipated, if you have a slight attack of diarrhoea, or if you feel chilly and have a slight touch of fever; go to the hospital, and by a timely dose of medicine it may be easily and readily cured. If you meet with an accident, or get bitten by any animal, reptile or insect, go to the hospital at once and get the wound or injury attended to without delay, it may be the means of saving your life."

The delay in reporting sick is, unfortunately, of too common occurrence, and often leads to the spread of some preventable disease before sanitary measures can be adopted to arrest its progress. This refers especially to infectious diseases and enteric fever. In cholera epidemics, which are of much less frequent occurrence in the present day than in former years, the observance of this rule is of the very greatest importance. There is a form of fever very common in India, produced by exposure to the sun, or caused by a chill, and there is also a form of fever due to exhaustion and lowered vitality, which may aptly be termed "the fever of exhaustion." Both these forms of fever are very common among young soldiers, and are especially incidental to military service, and it is when the system is in such an enfeebled, feverish, and debilitated condition that the young soldier is particularly liable to contract other serious diseases to which he may be exposed, and that are prevalent in the locality. It should therefore be impressed on all ranks that the delay in reporting sick, often from thoughtless, selfish motives, is not only dangerous to the individual, but also to others. With regard to wounds and injuries, more especially the

bites of rabid dogs, or venomous reptiles, it is absolutely necessary that immediate action should be taken in order to save life.

“(4) Do not have a long drink before meals, it weakens digestion, and also makes you disinclined for food. Eat your food slowly, and masticate it well; when food is eaten hurriedly it produces pain, flatulence, sickness and diarrhœa.”

The habit of drinking before meals is common among the working classes, who invariably drink beer at some public-house on their way home to their mid-day dinner; the beer being, therefore, drunk before and not with dinner. It has been customary in the Service to open the canteen before the dinner hour for the same reason, the men preferring to drink beer before their dinner, and personally I see no reason to alter their custom, provided, of course, that no one is allowed to drink more than one pint of beer or stout. I do not think that this amount of beer would be injurious to those who are accustomed to drink it, but if a larger amount is consumed by any man, he becomes drowsy, satiated, and disinclined to eat his dinner. A better arrangement would be to issue the beer in the dining-room of the barrack, or mess, so that it could be drunk during dinner. In many regiments, I believe, this arrangement is in force. This rule equally applies to drinking a large quantity of water or mineral water just before meals, as the action of the gastric juice is thereby weakened, and digestion interfered with. As regards eating food hurriedly, and without masticating it sufficiently, the injurious effects caused by indigestion are too well known to need any further remark.

“(5) Do not drink to excess, a moderate amount of beer, say a pint with dinner, and a pint in the evening, may do a man no harm; but a larger quantity of beer, or indulgence in spirits, produces nausea, pain in the stomach, colic and diarrhœa, a disinclination for food, and a restless, unhappy condition.”

The ultimate and certain result of excessive drinking in this country is that the bodily system becomes so enfeebled that it is unable to resist any serious illness, and it is a well-known fact that abscess of the liver, a very dangerous and fatal disease, is commonly caused by excessive drinking of beer or spirits. Owing to the existence of the coffee-shop, supper bar, Royal Army Temperance Association and similar institutions, excessive drinking is gradually disappearing, and many men in every unit are found to be total abstainers. There are many diseases caused by excessive drinking, all of a very serious nature. The habit becomes a mania, and

before very long the person addicted to excess becomes a total wreck, both physically and mentally, and utterly useless.

"(6) Do not eat any fruit that is unripe and hard, and do not eat any fruit that is over-ripe and in a soft, fermenting state; they both may produce great pain, colic and diarrhoea, and sometimes may predispose to cholera."

This rule is very important, and its non-observance attended with severe abdominal symptoms, sometimes terminating fatally. I remember the case of a young soldier in the King's Own Scottish Borderers who was suffering with severe colic and hæmorrhagic stools due to his having eaten some hard, unripe pears, and his reason for having eaten them was because he was told that they would not get any riper. Fruit should be eaten when ripe, but not over-ripe. Another very important point in connection with the eating of fruit sold by native hawkers is that all fruit should be washed and peeled, if possible, before being eaten. It is quite a common practice for natives to soak a piece of dirty cloth in foul, contaminated water and then place it over the fruit, the consequence being that the fruit becomes contaminated with infective material; such fruit has been known to cause dysentery and enteric fever.

"(7) Do not eat or drink anything that is manufactured in the native bazaars."

This is one of the most important rules. A very large proportion of sickness, notably, enteric fever, has been traceable to the consumption of bazaar-made articles of food and drink. There should be no necessity for any soldier to eat or drink in native bazaars, owing to the various means provided in barracks to meet all his requirements. The want of cleanliness in manufacture, and the insanitary surroundings in all native bazaars, render articles of food and drink liable to contamination, and become sources of infection.

"(8) Do not drink water from any stagnant pool, pond, tank, ditch, or well; all such water is often of the foulest description and liable to cause very serious illness. It is better to restrain your thirst until you return to barracks, where the water is good and wholesome. Only tap-water from stand-pipes should be drunk."

The last sentence refers to a pure piped water supply, such as we have in Agra. The drinking of water from pools, ponds, tanks, streams, rivers, or wells is fraught with very serious danger to health, owing to the habits and customs of the natives of this country, whereby all such water is contaminated and rendered unfit

for drinking. Where the necessity arises water should be boiled before drinking, in order to destroy the infective bacteria that it contains. This sanitary measure is adopted on the line of march, in standing camps, on field service, &c. ; but it must not be accepted that enteric fever, dysentery, cholera, &c., are only contracted by drinking an impure water supply ; there are many other channels by which the infection is conveyed, yet, as foul, dirty water, and water from the above-mentioned sources, is frequently a recognised means of infection, soldiers should be especially cautioned against drinking any water that has not been passed as fit for drinking. Many years ago, I remember being on the line of march with a mountain battery. The men, mules and horses waded through a muddy stream, and one of the men stooped down, formed his hands into a cup and drank some of the water. His example was immediately followed by three or four others, but, fortunately, I happened to see it and immediately stopped it. Shortly after arrival at the practice camp two of these men were admitted to hospital with enteric fever. There was a plentiful supply of drinking water accompanying the battery, and no need whatever for drinking this muddy water. While in South Africa I happened to be in medical charge of a cavalry regiment, and on more than one occasion I found men of other mounted corps drinking water from shallow ponds that was quite unfit for consumption. I remember one trooper wading his horse into a shallow, filthy pond, the water in which was so foul that his horse refused to drink it, though parched with thirst ; but to my horror the rider dipped his water-bottle from his saddle into the pond and drank the water. No doubt every sanitary precaution was taken in his own camp for the proper boiling or filtration of drinking water, and he might have filled his water-bottle from a water-cart, with a little extra trouble and a longer ride ; but what good purpose can it serve when men, directly they get out of the precincts of their camps, where good water is provided, will purposely and thoughtlessly drink any water that they may come across. The supply of a sufficient number of water-carts to accompany each unit is the only way to prevent the drinking of water from dangerous sources. In my opinion there should be at least one water-cart per squadron to every cavalry regiment, and at least one water-cart per company to every infantry battalion.

“(9) Do not expose yourself unnecessarily to the sun. The direct rays of the sun are very liable to cause fever. Never go out in the sun without sufficient covering to your head.”

Exposure to the sun is one of the most potent factors in the causation of fever, apart from sun-stroke and heat apoplexy. The glare caused by the sun is very powerful, and affects the brain through the optic nerves. I am, therefore, strongly in favour of all men wearing darkly tinted spectacles to shade and protect their eyes during the hot weather months.

“(10) Do not forget to wash your hands before partaking of any food. If you sit down to meals with dirty hands you are sure to infect and pollute the food that you touch, and which will make you ill by eating it.”

The washing of hands before meals is a very important matter, but not generally performed. I think much may be done to encourage soldiers to carry out this rule.

“(11) Do not omit to throw a scoop of dry earth into the pans after use in the latrine; it acts as a deodorant and purifier, and keeps the latrine clean and without smell, and prevents flies from settling in the pan. Flies are liable to convey filth to food and drink.”

This rule, I regret to say, is not observed as strictly as it should be. Flies are consequently attracted to the pans, and convey infective material therefrom to articles of food and drink, thereby causing serious illness, such as dysentery, cholera, and enteric fever. Every man should be instructed to sprinkle the dry earth into the pan, and on no account to use a latrine pan that has previously been used, and especially if dry earth has been omitted. A duplicate supply of pans should be provided in all latrines, so that as soon as a pan has been used it can be removed and cleaned, and the duplicate pan placed under the seat. The supply of latrine paper to all latrines is a sanitary measure of the greatest importance; the cost would not be prohibitive, and it should be provided.

“(12) Do not soil the ground around the urine tubs.”

With a little care this could be easily prevented. The decomposition of urine close to the barrack-room is sure to produce illness, and is very offensive. The fouling of the ground around urine tubs is a very serious danger to health. This is frequently due to carelessness. Every man should endeavour to use the tub without soiling the floor around it. The following article has been tried, and found most suitable and serviceable in preventing urine from being passed on to the ground around the urinal. It consists of a tin cover, in the shape of a hip-bath, fitted with a rim and collar to support it on the top of the urine tub; the urine is passed into it from one

direction only, and enters the urinal without any possibility of being voided on the floor around (fig. 1).

"(13) Do not neglect your personal cleanliness. You should bathe every day, and keep your clothing, especially your underclothing, as clean as possible."

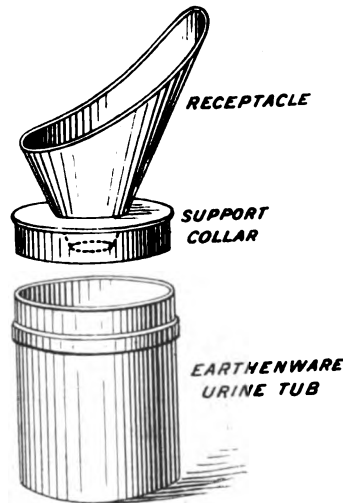


FIG. 1.

Cleanliness is of paramount importance in the maintenance of health. In India men should be encouraged to bathe daily. The use of the tooth-brush and washing of the mouth would not only improve the health of the soldier, but also preserve his teeth, which, unfortunately, otherwise rapidly decay and render him inefficient. Personal cleanliness and cleansing of the person are two of the most important rules to be impressed on the soldier. Clothing that has been worn during the day should not be slept in at night; it should be taken off, dried and aired before being worn again. All men should be supplied with sleeping suits to sleep in; it would add materially to their comfort and health. If every man were able to provide himself with two sleeping suits, the cost and upkeep would not be great, and the advantages obtained would be very great. In this country three bed sheets and two mattress cases are supplied to each soldier. I would prefer to see four bed sheets and one mattress case, so that two bed sheets could be at the wash and two in use. The need for two mattress cases does not appear necessary. If a certain number of mattress cases

were kept in store as a reserve, and calculated at a certain percentage, it would be quite possible to replace temporarily any mattress case that required repairing or washing. One mattress case ought to be enough for one man, and, financially, there would be a saving in issuing four bed sheets and only one mattress case. It often happens that men allow both bed sheets to go to the wash, and sleep on the mattress case covered with one sheet, an unsatisfactory and unsanitary arrangement.

“(14) Men are particularly cautioned not to have any communication whatever with women who loiter about the vicinity of barracks and cantonments for immoral purposes, as these women are prostitutes of the worst class who are very badly diseased.”

This is a matter of very great importance, for obvious reasons. In my opinion, much of the venereal disease contracted in this country is due to promiscuous intercourse with vagrant prostitutes. The great risk that he runs in disregarding this rule should be impressed on the soldier, and above all that the only safeguard from contraction of venereal disease is instant ablution. I consider that the reduction in the number of cases of venereal disease is due to a great extent to the use of the special washing compartments provided in barracks. Much, however, remains to be done in the prevention of wayside prostitution, and the recent orders on the subject will go far in lessening, if not entirely removing, this evil.

“(15) Do not forget that your health and physical condition and life lies, to a great extent, in your own hands.”

Every soldier should be taught to know that by attention to his bodily health, the avoidance of bad habits, and the exercise of reasonable care in his daily life, he need have no fear of the many causes of disease, all more or less preventable, that are met with in his military career.

A RAPID AND PRACTICAL METHOD OF DIAGNOSING TYPHOID FEVER.

BY CAPTAIN L. W. HARRISON.

Royal Army Medical Corps.

IN an article by Lieutenant-Colonel R. H. Firth in the *Journal of March*, 1904, the suggestion was made that with a view to differentiating fevers of the type of typhoid, and clearly classifying their causal agents, whether typhoid or paratyphoid, cultures should be made from the blood. I cannot remember having seen the suggestion of routine examinations of the blood by culture as a rapid means of diagnosing typhoid fever put forward.

Drs. Coleman and Buxton, of New York, in their report, based on 604 bacteriological examinations of the blood (reviewed in the *British Medical Journal* of November 21st, 1904), consider a bacteriological examination of the blood unnecessary in the majority of cases from the point of view of diagnosis.

My object is, if possible, to demonstrate the value of a routine examination of the blood by blood culture in every case of fever admitted to hospital in India or the Colonies where there is a reasonable suspicion that such case might develop into typhoid fever or one of its allies. It will generally be conceded that the earlier the diagnosis is established in a case of typhoid fever, the better from a sanitary point of view, because less time will then have been lost in taking the necessary precautions to prevent the spread of the disease.

At present, we can look for a certain diagnosis on the eighth day of the disease, and even then, our minds are occasionally thrown into doubt by an equivocal or negative Widal reaction. Of course, the undoubted case with typical book symptoms stands revealed from the first, but unfortunately the majority of cases are by no means so straightforward. In the Punjab, at any rate, a large number of cases are admitted which, after presenting the symptoms of mild typhoid, clear up completely after nine or ten days. Such cases are found not to give the Widal reaction and cannot be diagnosed typhoid fever. The possibility of a case being of the type just described holds the hand of the disinfecter till the arrival of the eighth day, when a Widal reaction may be tried for, and during the interval, if the case prove to be one of typhoid fever, valuable time has been lost. A method, then,

which promises a certain diagnosis on the second day in hospital, particularly one so simple as that about to be described, will be admitted to have advantages over methods in vogue at present.

Coleman and Buxton obtained positive results in 93 per cent. of cases where a culture was made during the first week of the disease, and the proportion of successful results decreased progressively in the second, third and fourth weeks, probably on account of the bactericidal substances which develop in the blood as the disease progresses and, being withdrawn with the blood, inhibit the growth of the contained bacilli. It may fairly be argued from this that the earlier in the progress of the disease the blood culture is made, the more likely is a successful result to be obtained, and by taking cultures regularly on the day of admission, *i.e.*, generally before the fifth day of the disease, there is every reason to hope that the above quoted 93 per cent. of successful results may be improved upon.

I have ventured to bring forward the results of such a small number as twelve cases in which a blood culture was made, without waiting to collect more, because material at Sialkot has now become very scarce, and I am convinced, from my results and those above quoted, that in the systematic taking of blood cultures in cases suspicious of typhoid fever we have in our hands the means of making early diagnosis in the great majority of cases, and so of checking at its outset the spread of this disease. Of the twelve cases from which I have taken blood cultures, three rapidly cleared up on the fourth or fifth day in hospital and were in no way cases of typhoid fever. Of the remaining nine, which were clinically and by Widal reaction cases of typhoid fever, successful results were obtained in six. The positive results were obtained in cultures taken on the second day in hospital in one, on the fourth in one, the fifth in two cases, and on the eighth in one. The negative results were obtained from cultures taken on the fifth day in hospital in two cases, and on the twelfth day in one.

The first case from which a culture was made by me was in December, 1903. Private X., 2nd Gordon Highlanders, was admitted to hospital with a temperature of 103·8° F. His blood on examination showed the presence of crescents fairly abundantly, and a diagnosis of ague might have been made. The temperature, however, remained persistently high, and the case began to present the clinical features of typhoid fever. His medical history sheet, however, showed an admission for typhoid earlier in the year. It

was clear then that a Widal reaction would be of no assistance in clearing the diagnosis, because the presence of agglutinins could be accounted for by the earlier attack. I took a blood culture and obtained a motile bacillus which was at once agglutinated by a 1 in 200 dilution of a goat's serum which had a maximum agglutinating power for typhoid bacilli of 1 in 300. The bacilli did not retain the stain by Gram's method. Unfortunately, the lamp of my incubator set on fire during the night and cooked my culture, so further investigation was stopped, but the bacillus had stood the crucial test of agglutination by specific serum, was motile, looked like typhoid, and might fairly be classed as typhoid.

The positive result described as obtained on the eighth day in hospital, should be described as obtained on the second of a typical relapse; the man was ill for fourteen days previous to admission, and his temperature dropped to normal on the seventh day in hospital. It, however, commenced to rise again almost at once in typical staircase fashion and dropped definitely to normal by lysis on the twenty-fifth day in hospital.

Of the other four cases from which a positive result was obtained, one had double pneumonia, which would have accounted for his symptoms in the early part of his illness, and the rest were ordinary cases.

The technique which I have employed is as follows: The patient's arm, at the bend of the elbow, is cleaned with soap and water, turpentine, 1 in 1,000 solution of perchloride in rectified spirit, and ether rubbed on; ether is then dropped on from a drop-bottle every few seconds till the puncture is made. The vein is made prominent, as for venesection. During this time an antitoxin syringe of 10 cc. capacity is being sterilised by filling with oil at 160° C. As soon as the syringe has cooled down to the temperature of the hand, the needle is given a final dip in the oil to destroy any germs which might have fallen on its point during the cooling of the syringe barrel, and is then, almost at once, run into the vein.

The puncture of the vein is very simple: the needle is kept almost parallel with the vein, the point is run through the skin and pushed steadily on; the eye of the needle should look upwards and the point is bound to enter the vein. The syringe is filled by withdrawal of the piston and the needle withdrawn from the vein. A flask of 500 cc. of broth is opened in the usual manner, and after expressing a few drops of the blood to wash off any germs which might have fallen on the eye of the needle during the

necessary interval between withdrawal of the needle and opening of the flask, the whole of the 10 cc. of blood is forced into the broth and the flask replugged. The flask of broth with the patient's blood is then put into an incubator and kept at a temperature of 37° C. In a successful result, after twenty hours, the broth is often found to be turbid, particularly if the culture is made early before agglutinins and bactericidal substances have developed in the blood. A loopful of the turbid broth is put out on a slide, covered with a slip, and examined with an eighth-inch objective. If motile bacilli are seen, a portion of antityphoid serum, of which the maximum agglutinating power has previously been ascertained, is suitably diluted with distilled water, a loopful of the diluted serum placed at the edge of the slip, and the effect watched. If agglutination occurs, one is in possession of the information that a patient admitted with fever has a motile bacillus circulating in his blood, which bacillus is agglutinated by a suitable dilution of antityphoid serum.

I think the information is sufficiently strong to justify a diagnosis and the consequent sanitary precautions.

I use a single flask of 500 cc. broth as against a number containing smaller quantities, because it simplifies the technique if only one flask has to be opened, though accidental contamination of the one flask might ruin the result. So far, I have not had a contamination in making the first culture. I think it is important to use a large quantity of broth, so as to well dilute any bactericidal substances which may be present in the blood and hinder the growth of the bacillus in its new environment.

It will be seen from the above that, given the possession of the simplest bacteriological outfit, and a very elementary knowledge of bacteriological technique, we have the means in our hands of converting uncertainty into certainty in the majority of cases at that early date when it is so important, from a sanitary point of view, that we should be certain. I know, of course, that one essential, the simple bacteriological outfit, is not at the disposal of every medical officer in India, and, in fact, I have had to make the above experiments with my own apparatus, which, being small, has been the cause of my often not having flasks of broth available to make cultures on the days of admission of the cases to hospital. One of my objects in writing this note is to provide another argument for all station hospitals in India being provided with a sufficient bacteriological apparatus to make these investigations.

The possession of a microscope with a few simple stains is acknowledged to be essential in all Indian and Colonial military

stations. Without them diagnosis is necessarily uncertain, statistics are worthless, and the results of sanitary procedure uncertain in value. The addition of an outfit to ensure that a few flasks of broth are always available for making blood cultures and for their subsequent investigation would involve a very small additional outlay. I venture to say that Rs. 150, carefully spent, would provide a very useful outfit in India, and after that an expenditure of Rs. 15 a month would keep the small laboratory running.

Against this expenditure we have the saving which must result from nipping typhoid epidemics in the bud, and that ensuing from treating cases on sure and certain lines.

I have made no mention of the advantages, in making blood cultures, of being able to differentiate typhoid from paratyphoid infections; those were more ably advocated by Lieutenant-Colonel Firth in his article above quoted.

RIDER'S SPRAIN.

By MAJOR P. G. IEVERS.

Royal Army Medical Corps (R.P.).

FROM the comparatively little attention that this accident has received, one would be led to suppose that it is of a trivial nature, or not sufficiently important to merit serious consideration from a surgical point of view ; but any one who has experienced this injury will bear me out when I say that, from its often tedious recovery, and the disability which it occasions, rider's sprain deserves the most careful study, both as to its causation and treatment, more especially as affecting the mounted branches of the Service.

It is now beyond doubt that the muscle engaged is not what is sometimes erroneously called the "tailor's muscle," but the adductor longus, which may be affected to any extent, varying from a slight sprain to more or less complete rupture of the muscle and its sheath or tendon. In severe cases the point usually torn is at its insertion into the rami of the pubes. Again, I have known the sheath of the muscle to be completely severed in addition to its tendon, and the belly of the muscle forming a large tumour in the upper or inner third of the thigh ; more often than not it is in the right thigh that the muscle gives way, and when there is much laceration one often finds very extensive ecchymosis extending in all directions from the part immediately implicated.

In this connection it will be observed that the situation and extent of this injury occupies a position in no way connected with the sartorius muscle. The latter may, of course, in common with any other muscle, meet with accident, but it is not involved in the particular injury which now claims attention.

Coming to the cause, this is usually owing to the extra effort occasioned in keeping one's seat, either in taking a fence, when the horse happens "to peck" badly, or, as in my own case, when in jumping a high wall, the horse unexpectedly attempts to "change," thereby causing the rider a sudden jar, the extra strain being sufficient to cause the muscle to give way.

In my opinion, it is highly important to recognise the possibility of this occurrence, even when few, if any, external signs are manifest, inasmuch as a slight sprain of this particular muscle will render the victim utterly incapable of taking a "grip" of the saddle, which has no doubt often led to a perhaps promising

recruit being stamped as a "scrimshanker" or duffer, simply because he is sure to fall off in the most helpless manner every time he mounts a horse; nay, more, I have heard of young cavalry officers being obliged to retire, solely, I believe, because the nature of their disability has formerly been imperfectly understood.

The treatment must be seriously taken in hand from the first, for, if neglected, the tendency of this accident is to become more aggravated. In this connection I advocate a somewhat similar procedure to that of a fractured bone, as, without proper support, how can the muscle properly unite if not kept in its place and sheath? I have therefore devised an appliance for this purpose, formed of the stoutest elastic band made, which should be 5 inches in width, stiffened by a couple of slips of whalebone let in at intervals, and cut so as to envelop in its circumference the upper portion of thigh, taking care that the opposite ends do not approximate by $2\frac{1}{2}$ inches, so as to admit of the required stretch to get a good grip when fastened by means of three straps and double or "whole" buckles on outer aspect of thigh. Further, it is essential that the upper edge of band be brought right up to the "fork." A suitable pad should be inserted inside the elastic band over seat of injury, and finally a soft leather strap, similar to a bridle rein, should be attached to a stud or buckle on upper and outer edge of appliance, then brought round the body and crossed so as to form a figure of eight over hip of side affected, and also fastened to a separate buckle attached to elastic band. By this means the great drawback of most appliances, *i.e.*, the tendency to slip down, is effectually prevented. With this appliance on, the patient is made quite comfortable, and could almost at once commence riding; but here I would recommend that sufficient time elapse for the repair, necessitated by the amount of injury sustained, to become healed, which ordinarily, in severe cases, would be two or three weeks at least, although I have known cases occurring in Masters of Hounds, when wearing the appliance here described, commence hunting much earlier, and amongst others, the present Master of the Blackmore Vale, one of the hardest riding men in England.

So far, the treatment has been directed to the actual repair and support of the affected muscle. That having healed, the next point required is to strengthen and bring back the lost power to the adductor longus, and it is at this stage that gymnastics, in the form of the cord and pulley apparatus, come into use. The latter can readily be rigged up in any room or corridor which

admits of a pulley, through which the cord pays, being screwed into a beam or other woodwork in the ceiling. The cord, which should be similar to that used in window sashes, must be sufficiently long to reach from ground to ceiling, and about 3 feet short of the floor again; to this latter, or short end, is attached a 7 or 10-lb. shot to commence with, whilst at the other, or longer end, is a strap and buckle fixed to cord, which fastens in figure of eight fashion over ankle of affected limb. The correct motion of the adductors can then be brought into play by raising and lowering the weight at other end, and by this means, and this alone, can the affected muscle be exercised, gradually at first, from ten to fifteen minutes at a time, once or twice daily, until greater liberties can be taken; when ultimately, in the course of a few weeks, this muscle should regain to a great extent its former tone, and even become stronger than its fellow, in which event, the sound leg should be also exercised, so as to bring both sides even; otherwise, the weakest is likely to give way on any further extra strain. I recommend, however, that for some time afterwards, when riding, the appliance be worn as a precautionary measure.

THE REMOVAL OF WOUNDED IN HILL WARFARE; A METHOD LATELY INTRODUCED INTO PRACTICE IN THE 30TH PUNJABIS.

BY CAPTAIN W. W. JEUDWINE.

Indian Medical Service.

THIS method is likely to prove useful for the removal of wounded of small groups left behind on a crest to cover the retirement of picquets, and was specially devised for such occasions. Later trials, however, show that it is useful also on the flat, and that a man can carry another heavier than himself for a long distance without undue fatigue, even if unconscious, as he could not possibly do in any other way. In hill fighting small parties remain in occupation of a crest-line long enough to give their picquets a good start, and then have to make the best of their way down. Usually in frontier warfare the enemy are up on that crest-line very soon after the group leave it, and at such short range there is every chance of a man being hit. There is no stretcher with the group, and even if there were, its use is impracticable on a steep hillside, besides taking two other men at least from the firing line. The usual method is to hoist the wounded man on to another's back. Not only is this a very fatiguing method and one which often requires stoppages to be made, but it presupposes some help from the man carried and the intelligent use at least of his arms, and the carrier has no power to help himself over difficult ground, as both his hands are employed in holding the man on his back; moreover, the man may be so badly wounded that far from assisting he may even embarrass the carrier.

With a view to overcoming the above defects the following method has been adopted in the 30th Punjabis. It has been tested on the bare khud-side and over broken nullahs and found successful. To begin with, four men per company have been taught, but the method is so simple that there is no difficulty in teaching it to all. The correct method will thus be ensured and also a minimum of time taken, which is an important consideration when an active enemy is following up a retiring picquet.

For the actual removal of a wounded man only one man is necessary, but two others are required to assist at first; when the wounded man is made secure one man is free to go on fighting if necessary and the other removes the rifles and either goes on ahead to find a path or can go on fighting again.

For instruction purposes the following drill is carried out :—

(1) A man lies down, as if wounded, in any position. The squad, consisting of three men, approach him, placing their rifles in a heap as they come up.

(2) No. 1 then quickly turns the patient upon his back and opens his legs wide apart. He then squats down with his back as near patient's fork as possible, lifting the wounded man's knees up over his own legs. At the same time Nos. 2 and 3 quickly pull off the wounded man's pugri, open it out and find the middle, which they place on the ground behind the wounded man's head.



(3) Nos. 2 and 3, standing respectively on the left and right of the wounded man, then hoist him up on to No. 1's back—his legs slip forward voluntarily and are controlled by No. 1. *The wounded man must be hoisted up on to No. 1's back so that the weight comes well on to his shoulders.* This is very important, as otherwise the weight comes too far down.

(4) While in this position he is held there by No. 2, while No. 3

quickly places the middle of the pugri well opened out under his seat and passes the left end to No. 2. The wounded man is thus supported by a pugri seat.

(5) Nos. 2 and 3 then bring up the ends of the pugri over No. 1's shoulders, cross them over his chest, bring them down, pass them inside and under the wounded man's hams up and on to his back, cross them and pass them over his shoulders.

(6) No. 1 seizes the free ends with one or both hands.

(7) Nos. 2 and 3 assist No. 1 to rise.

(8) No. 3 seizes his rifle and continues firing, No. 2 seizes the other three rifles and either accompanies No. 1, going 20 yards ahead to find a way, and assist over very bad ground, or, slinging two of the rifles, covers the retirement by using his own.

The time employed from start to finish is now only one minute, and with further practice this will be improved upon, some squads now taking as little as forty seconds.

For active service the following points must be impressed on the men :—

- (1) To lay their rifles close at hand.
- (2) To drag the wounded man just under cover if possible.
- (3) To place him on a slope with his head up; this facilitates loading up.

The advantages of this method are many—

(a) No stretchers are wanted at all; (b) the man can be carried where a stretcher is impracticable; (c) stretchers even if taken are an encumbrance and may not be handy, and certainly will not be available in case of retirement from isolated points; (d) all dead and wounded must be removed in frontier fighting, and this must be accomplished by the men on the spot; (e) the number of men taken from the firing line is one more for about a minute than would be necessary if the man was simply hoisted on to another's back, but once there a man is saved for the firing line; it takes two at least, if not three, to remove a man on a stretcher; (f) the carrier has one hand free if necessary to balance himself by; when a man is simply riding pick-a-back the carrier has no hand free; (g) an insensible or dead man cannot be carried by a single man for any distance; by this method a man can carry another of greater weight for a long distance if necessary, as proved by actual experiment; (h) only a small mark is offered to the enemy; (i) the rate of progress is comparatively fast; (j) the wounded man is absolutely secure and cannot fall off if he tries, and does not sway from side to side, but is firmly held on to the carrier.

THE INSPECTION OF TINNED FOODS.

By MAJOR W. W. O. BEVERIDGE, D.S.O.

Royal Army Medical Corps.

OWING to recent revelations with regard to tinned food in America much unrest has naturally prevailed, and the desire to ensure the provision of pure food has very greatly increased. The latest figures have shown that in 1906 the total meat produce exported from the United States will amount to £39,210,000, of which Great Britain takes no less than 90 per cent.¹

During the war in South Africa, rather more than half of the whole amount of tinned food supplied to the troops came from the United States.

In the army at home, during peace time, comparatively very little tinned foods are used, but a certain amount of tinned provisions are sold in the canteens, a considerable proportion of which are consumed by women and children. It is during campaigns and in our Colonies, particularly South Africa, that for various reasons the need for tinned provisions to supplement fresh food is essential. At the close of the late war in South Africa large quantities of tinned provisions were condemned as unfit for issue, and, undoubtedly, very rightly. Unfortunately, in tinned foods, there can never be any certainty that the animals from which the meat was obtained were healthy,² and hence the necessity that the manufacture of these goods should be controlled, and that the premises should always be open to inspection.

From my own observations in South Africa the deterioration of what was really a small part of the enormous quantities necessary to such a large campaign was almost entirely due to exposure to climate, sun and rain, combined with a too lengthened period of keeping before issue. This was unavoidable. It was impossible to keep tinned foods in such quantities under efficient cover in the open veldt, and even in large towns the difficulties were great.

In 1903 several cases of ptomaine poisoning occurred among the troops stationed at Pretoria, all in about one week, and we traced them conclusively to certain tinned hams. On this being reported, the General Officer Commanding at once ordered a Board on all

¹ *Daily Telegraph*, June 23rd, 1906.

² Osterag.

the tinned provisions that were in the Command. To ensure no unnecessary loss to the Government I advised that at least 10 per cent. of the whole stock should be examined and opened, and it is fairly certain that if 10 per cent. are found bad there is no doubt about the remainder, which can be safely condemned. This, at least, was our experience. It involves considerable labour, and at the Board in question we found it absolutely necessary to condemn about 330,000 tins, some of which were so putrid as to be practically unapproachable on opening; others were more dangerous in being only slightly deteriorated and therefore more liable to be consumed unawares. No further cases of ptomaine poisoning followed, and as the tins condemned were all tins which had survived the war, and were mostly over three years old, the probability is strong that the meat in the first instance was not the offender. The tinned rations issued to the troops in the field were, from the great demand, never kept for any great time, and hence, actually in the field, there were few complaints of deterioration of rations or disease resulting therefrom.

The importance of careful and complete inspections of these supplies to the Army cannot be over-estimated. The danger to the consumer of deteriorated food is a very real one, and is very frequently not detected until a case of ptomaine or metallic poisoning draws attention to its presence. The cause is then sought for, the supply discontinued or destroyed when traced, and the danger ceases. All this means time, and possibly a considerable loss to the Government. To obviate this, frequent inspections, at least every six months, of the whole supply of tinned food should be insisted upon, and large supplies, except in the case of war supplies, should never be maintained. The danger of large supplies, although unavoidable, was well shown during the late war in South Africa, when it was found necessary to condemn in the last year of the war many thousands of tins. This was in a great part due to the immense supplies which were necessary to such a large campaign. In many cases, owing to want of space, necessity of concentrating the stores, and economy of labour, tinned provisions were arranged in high stacks. As more supplies arrived they were added to the existing stacks. As issues were made the tins were taken generally from the top, so that those at the bottom, in some cases, remained until the end of the war, and some of those, at least, which came under my notice and were condemned as unfit for food, came under this category.

Now the question will arise how long, under different conditions, is it safe to store tins of food before issue?

From a considerable practical experience when analyst during the late war, I am of opinion that no meat stacked in the open, exposed to changes of temperature, heat of the sun and effects of rain in warm climates, should ever be kept for more than one year. When under suitable cover, perhaps for two years, but never more, and in all cases should be inspected at intervals. The reason of this is not so much in the meat itself as in the tin. During transit, knocking about in lading and unlading ships, in trains and carriage by road, the paint on the tins becomes cracked or knocked off. If the tin is now exposed to damp, especially damp with heat, rusting rapidly follows, attacking more especially those portions of the tins which are dented or scratched, and very soon a hole results. This hole in the tin is frequently very minute, but sufficient to allow the entrance of micro-organisms, fermentation and putrescence of the contents rapidly following. It has been shown that on long keeping a certain change, of the nature of adipocere, not understood, sometimes takes place in the meat itself, which is another argument against long keeping.

The custom of surrounding tins with paper labels in war-time should be discouraged, as, when wet, from water soaking through the boxes in which they are packed, the paper becomes sodden, retains the moisture and in some cases ferments, increasing the danger to the tins themselves. For the above reasons, tins should be invariably painted, with as thick a coat as possible: unpainted tins should not be accepted.

In stacking tins in the open some arrangement must be made to allow a free circulation of air around each tin. This can be carried out by placing the tins in rows, with a small interval between each on a raised platform. Over the first layer some wire netting or slabs of wood should be placed, and on this again the succeeding layers alternating with the wire netting or wood. Stacks should never be so large that the lower layers are not issued within a reasonable time, and they should be numbered for regulated issue.

The danger of consuming deteriorating food is, I think, not sufficiently recognised, and the habit of leaving exposed the contents of opened tins is only too common among the families of soldiers, and has led to many cases of ptomaine poisoning. When Sanitary Officer of Cape Colony many cases among the women and children came under my notice from this cause alone, although the tins and their contents were originally sound.

The foods which are to be considered the most dangerous are those containing much moisture, such as tinned milk, salmon,

lobster, and mixtures of meat and vegetables. The more acid food, such as fruit, jams and vegetables, are more liable to take up metals from the tins.

Certain kinds of tinned food do not keep so well as others. It was found during the war that corned-mutton, on the whole, kept better than beef. The simpler the preparation the better it withstands effects of climate and heat. For instance, corned or bully-beef was far superior to mixed preparation of meat and vegetables. The latter did not, as a rule, keep well, owing to the vegetable acids, which eventually attacked and corroded the interior of the tins, and also absorbed certain amounts of metal from the interior. Tinned hams and bacon, likewise, did not keep well.

Most of us are called upon to examine supplies of tinned food, either as members of Boards or to give expert evidence, and the points which demand attention are as follows:—

(1) *The Age of the Supplies.*—Many makers mark their tins with the date, and this is now generally insisted upon. In many cases the date marked, *e.g.*, 31.5.05, will be found stamped at either end; in some, on the label, which is liable to be torn off, and therefore insufficient. A general idea of the age of the tins can sometimes be arrived at by mere inspection. The longest period that contractors can be expected to guarantee their tinned foods under favourable conditions, should be taken at two years, not longer; but in the case of mixed meat and vegetables, six to twelve months should be the limit in hot climates.

During the war I frequently had samples of the emergency rations sent for an opinion as to their suitability for issue, and it was found on examination in thirteen different samples that they were quite unfit, having become mouldy, the cocoa being of the two portions most frequently deteriorated. This was due entirely to prolonged storage or exposure, and to the band of tin, which is soldered around the two portions, becoming partially detached.

(2) *The External Condition of the Tins.*—During the preparation of tinned foods the cooked meat is placed in the tin, which is then subjected to steam at a temperature of about 125° C., or sterilised by submersion in boiling brine, and then immediately sealed up, after the steam has escaped. Thus a partial vacuum is formed which gives to the end of the tin a slight concave appearance. In a good tin of meat the concave ends are generally present, whereas in a tin in which the contents have undergone fermentation, the ends are likely to be bulged outwards owing to the presence of gases, the products of fermentation.

A word of warning must be given with regard to this appearance of bulging. I have frequently had tins sent to me condemned as unfit, owing to apparent bulging caused by external pressure, the tins being dented, but on opening these the contents were shewn to be quite sound.

As a rule during the canning process, two holes are made in one end of the tin to allow the steam to escape before the final soldering. The tins, therefore, should be carefully inspected as to any evidence of re-soldering, or the presence of a third or more soldered holes, which frequently may be found at the margin or rim of the tin or even below the paper label. This points to the tin having been punctured to remove any gases due to commencing putrefaction, and then again being re-soldered up, by dishonest makers. Tins which are greatly dented or crushed should be treated with suspicion, for a minute opening may be found in the depression, from which the gases have escaped, and no bulging results, but the contents may be found to be either putrefied or mummified. In the latter case, on shaking the tin the rattling of the contents makes this apparent.

Dented tins should always be issued early, if otherwise fit. Tins which show much rust make it probable that they are old, or have been subjected to rough usage. Frequently tins in wooden cases which have laid in holds of ships show much rust, due to soakage from sea-water. Rusting is very often followed by perforation.

(3) *The Condition of the Interior of the Tins.*—On opening certain tins of preserved food, and especially tins of marmalade, rhubarb, tomato soup, some vegetables and mixtures of meat and vegetables, it will be noticed that the interior presents a blackened appearance in a more or less degree. This is due to the action of the vegetable acids on the tin-plating, and in extreme cases may lead to actual corrosion of the surface and solution of the metals. If the blackening is slight it is, as a rule, of no great importance, provided no fermentation, evinced by minute gas bubbles, of the contents is present.

During the War in South Africa, samples of marmalade were sent to the Army Medical Services Laboratory from the Director of Supplies for report. On opening the tins, the contents were seen to be in a state of fermentation, the interiors quite black and corroded in places by the action of the acids that were present. On analysis of the juice, both by the Government Analyst at Cape Town and myself at Pretoria, very heavy traces of tin and iron were found, showing the danger to health which may result from

such a condition. Luckily, in my experience, the salts of lead were of very rare occurrence, and when present were probably due to solder accidentally gaining access to the tin.

Leach¹ has shown, in a series of analyses carried out in the author's laboratory, "that a wide range of variation exists in the amount of tin dissolved by various fruit juices."

"Eleven samples of canned blueberries were examined by Worcester in 1894, showing an amount of tin in solution (calculated as SnO_2) varying from 0.0066 to 0.27 grammes per can of 615 cc. capacity." So that the danger is undoubtedly a real one, although cases of tin poisoning are very rare. The effects of small quantities of tin on the human system are not definitely known or agreed upon, but if continued, or in any quantity, the results are liable to be injurious. With lead it is otherwise, and the least trace is sufficient to condemn the food. Traces of lead are chiefly to be found in tinned fruits and vegetables.

It has been shown by Leach, that in general the amount of tin dissolved in tinned foods in three months was the maximum amount, and that practically afterwards no further solution took place, and also that the amount of tin dissolved varies proportionately with the strength of the acid present.² This interesting conclusion shows the importance of an analytical examination of samples of all supplies, before being passed as suitable for issue to troops in the field.

Zinc salts are sometimes found in tinned foods, and are generally due to a solution of ZnCl_2 having been used in the soldering. In some few cases I found zinc salts in tins of jam in South Africa, but only in mere traces.

(4) *The Condition of the Contents.*—Decomposition can take place by incomplete sterilisation or by incomplete sealing of the tin. In tins which have gone bad, as before stated, the ends are usually bulged, due to accumulation of the gases of decomposition. These gases are chiefly hydrogen, carbon dioxide and hydrogen sulphide. A test is to open the tins in doubtful cases by means of a puncture under water, when any gases present will bubble out. In some cases a little gas will escape from tins containing perfectly sound meat, being due to retained air in the interstices of the meat, owing to incomplete exhaustion during the process of sterilisation, but which, being sterile, is of no real consequence and amounts to, as a rule, only about 1 cc. or so.

¹ "Annual Report Massachusetts State Board of Health," 1899.

² "Food Inspection and Analysis," Leach.

Doremus¹ collects the gases from the tins, by means of an adjustable clamp, provided with a perforating steel needle passing through a rubber stopper. The gases are collected into a eudiometer by a tube, both being filled with mercury. The gases can then be analysed in the usual manner. The amount of gas from a tin varies from 50 to 80 cc. Much bulged tins give a dull sound on percussion and a crackling on pressure.

Prescott and Underwood, quoted by Leach, adopt the following method:—When the swelling is not apparent the tins are boiled for one hour, which causes, by expansion, the ends of all to swell, they are then cooled and set aside for eight hours, when the sound ones will return to their former condition. The unsound ones will remain bulged, as the convexity is due to the presence of gases. This is a useful test and worthy of trial.

Viry calls attention to the fact that putrefaction may take place in tinned meats without the formation of gas, but so far I have not been able to confirm this.

The most reliable test, of course, is to open the tins, when any doubt is at once dispelled. If, as one frequently sees, there is any trace of mould shown by the presence of patches of blue (or yellow) (*penicillium*, *aspergillus*, *mucor*) the tins must be condemned, sterilisation not being efficient. Moulds are more often seen in the case of jams and jellies, and occasionally in sterilised milk. They impart an unpleasant taste to the food and are liable to cause diarrhoea.

Decomposition of meat is easily recognised when advanced, the smell of decomposed tinned meat being most sickening. A most important test of the presence of putrefaction is the liquefaction, even at a low temperature, and discolouration of the gelatine, which in sound meat should be firm, and this should always be examined. Decomposing meat has an alkaline reaction, due to the formation of ammonia.

Eber's test for the decomposition of meat is useful, but is not absolutely reliable, owing to the presence of trimethylamine, in, for instance, mutton and most pickled foods.

The test is performed as follows:—A small quantity of the reagent, which consists of one part sulphuric ether, one part pure HCl. and three parts ethylic alcohol, is placed in a test tube or other suitable vessel. The material to be examined is smeared on to the end of a glass rod, which is dipped below the surface of the re-

¹ *Journal American Chemical Society*, 19, 1897.

agent but is not allowed to touch the side. If ammonia be present a cloudiness appears or fumes may be given off.

The colour of decomposing meat is generally in shades of green or grey, and is well known.

The rancidity of butter is detected by smell and taste, being due to the decomposition of butyric, caproic and capric into their fatty acids, and needs no further notice.

As before stated, in making inspections of supplies of tinned provisions, at least 10 per cent. should be opened and examined.

The danger of issuing bulged tins is not great, as the condition is so well known and would at once be detected. In all cases of doubt, samples should be sent to an analyst, and in sending these, care should be taken that they are a fair and sufficient sample of the whole, for it must be remembered that the analyst reports merely on the sample sent for examination, but his responsibility is very great.

As an example, I had a sample of marmalade once sent for analysis, consisting of a few tins which showed no deterioration; as there was some doubt, I asked for a further sample of two cases from the same consignment and found that every tin in these particular cases was bad. The original sample was evidently not a fair one, and if the first report had been final, the whole consignment would have been passed as fit for issue.

This paper lays claim to no originality, being merely the outcome of practical experience gained during the War in South Africa, when the quantities of tinned provisions supplied to troops in the field exceeded all past records. Considering the enormous supplies, the difficulties of transport and storage (the latter being under the most difficult conditions), the immunity which the troops undoubtedly enjoyed from any disease traceable to deteriorated food is remarkable, and any fear that they suffered in this respect can be confidently set aside.

SOUTH AFRICAN STOCK DISEASES.¹

BY COLONEL DAVID BRUCE, C.B., F.R.S., D.Sc.

*Royal Army Medical Corps; President of the Physiological Section of the British Association, 1905.**(Continued from p. 30.)**(2) Redwater or Texas Fever.*

I may dismiss this disease in a few words. It is a most interesting disease, and of great importance to stock farmers. It only affects cattle.

Geographical Distribution.—It is found in almost every part of the world. It was first studied in North America; hence the name Texas fever. To Kilborne and Smith is due the honour of elucidating the causation of this disease, and their work forms one of the most interesting chapters in the history of pathological science. The following map, prepared by Professor Nuttall, F.R.S., Cambridge, represents the distribution of these piroplasma diseases over the whole world, as far as is at present known.

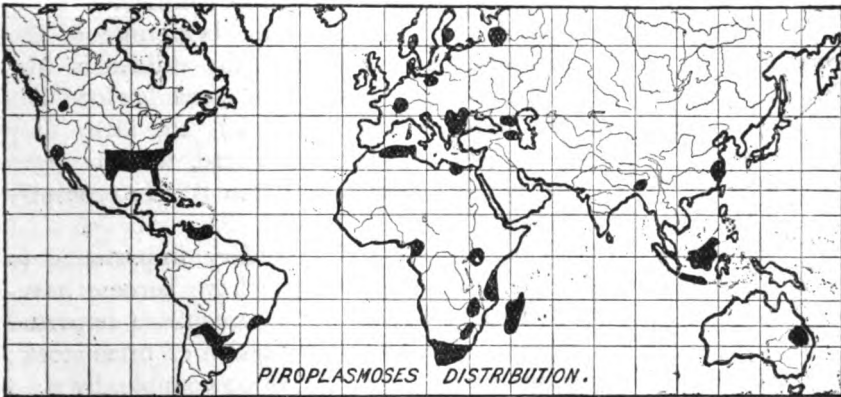


FIG. 3.

Nature of the Disease.—Kilborne and Smith discovered that it was caused by the presence in the red blood corpuscles of a protozoal parasite closely related to the parasite found in East Coast fever, and called by them *Piroplasma bigeminum*. They further discovered that this parasite was conveyed from sick to healthy cattle by means of a tick (*Boophilus bovis*). They also showed that

¹ Address delivered before the Physiological Section of the British Association for the Advancement of Science, at Johannesburg, August 29th, 1905.

the cattle born and bred in certain southern districts are immune to the disease, whereas cattle in the northern districts are susceptible. Hence, if southern cattle were driven into the northern district, they gave rise to a fatal disease among the northern cattle; and *vice versa*, if the susceptible northern cattle were driven into the southern district among the apparently healthy cattle of that district, they took Texas fever and died.

Texas fever was introduced about 1870, and is now endemic throughout most of South Africa. For many years the native cattle have been immune to the disease; that is to say, on account of being born and bred in a Texas fever locality they had inherited a degree of resistance to the disease which enabled them to pass through an attack when they were young, and so they became immune. But there is one peculiarity about Texas fever which does not occur in Rhodesian tick fever, and that is that the blood of an animal which has recovered from Texas fever remains infective—the germs remain latent—and so the native cattle of South Africa, although apparently healthy, are capable of infecting imported susceptible cattle with this very fatal malady. This is what makes it so difficult to import prize stock into this country.

When the Boers visited Mooi River, at the beginning of the war, they found a prize short-horn bull carefully stabled in Mr. P. D. Simmon's farm. They killed most of his stock for food, but left this shorn-horn bull alive. When they left the farm they turned it into the nearest field, in order, of course, that it might procure food. They had much better have eaten it. It promptly took Texas fever and died.

This disease, then, has become of secondary importance to South Africa in these days. The native cattle have become naturally immune, and the disease is only fatal to susceptible imported cattle. This, of course, discourages the importation of prize stock; but with the knowledge we possess it ought to be possible, by good stabling and prevention of contact with tick-infected cattle, to keep the prize stock alive for a reasonable time. The question of the feasibility of immunising the prize stock while calves in England, might be considered.

In regard to methods of conferring immunity on susceptible cattle many have been tried, but none are absolutely free from risk.

We may sum up in regard to redwater or Texas fever by saying that our knowledge of its causation and methods of prevention are much the same as they were ten years ago. The work done by Smith and Kilborne on this disease was of such a brilliant nature,

and was done so thoroughly, that little has been left for later workers to do.

(3) Biliary Fever of Horses, Mules and Donkeys.

This is a disease of horses, mules and donkeys, very similar to redwater in cattle, and is caused by a closely allied parasite, the *P. equi*, discovered for the first time in South Africa by Bordet, Danysz and Theiler, and named by Laveran, of Paris.

It is similar to redwater, in that animals which have recovered from the disease remain a source of infection during the remainder of their lives to susceptible animals. The native South African horse is, like the cattle, immune to the disease. It is also conveyed by a tick, which has been shown by Theiler to be the "red tick" (*Rhipicephalus evertsi*), the infection being taken in the nymphal and transferred in the adult stage.

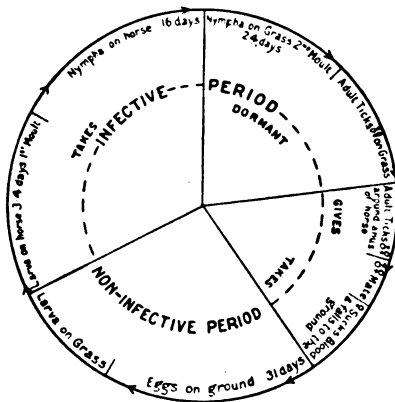


FIG. 4.—Life Cycle of Ticks with two Hosts. *Rhipicephalus evertsi*. Biliary Fever of Horses, &c.

Theiler has also made the important observation that if a horse is injected with blood from a donkey which has recovered from the disease, as a rule a mild form of the disease is produced, so that this opens up a method of immunising susceptible horses which may prove of practical value. Theiler has also made another curious discovery. This disease of horses was found to greatly complicate certain immunising experiments he was making against horse-sickness. He found he was introducing the *P. equi* at the same time he injected

horse-sickness virus. But he found out that as the virus of horse-sickness keeps its virulence for years, whilst the *P. equi* dies out in a short time, this danger could be avoided by keeping the horse-sickness serum and virus for some time before using them.

(4) Malignant Jaundice of Dogs.

This disease is most important to sportsmen or importers of valuable dogs, as most of these animals are attacked sooner or later by this disease, and most of them succumb. It is also caused by

a species of *Piroplasma* (*Piroplasma canis*), and is spread by the dog-tick (*Hæmophysalis leachii*).

Like redwater and biliary fever, the blood of dogs which have recovered remains infective.

The story of the tick infection is a curious one; and the credit of its discovery is due to Lounsbury. It is only in the adult stage that the tick is capable of producing the disease. It is therefore evident that the *Piroplasma* must remain latent in the egg, the larval and nymphal stages, and only attain activity in the adult stage.

According to Theiler there exists a peculiar phenomenon which may be made use of to confer immunity. The blood of a dog which has recovered from this disease and has been hyper-immunised is, as mentioned above, capable of giving rise to the disease in a susceptible dog. Now, if serum be obtained from this blood and a quantity added to a small amount of the blood, this infected blood loses its infectivity and no disease results.

II.—DISEASES CAUSED BY PARASITES BELONGING TO THE GENUS TRYPANOSOMA.

(1) *Nagana or Tsetse-fly Disease.*

We now come to the second group of diseases. These are also caused by blood parasites belonging to the same class of living things as the *Piroplasma*, but they are free organisms, swimming in the fluid part of the blood, and not contained in the red blood corpuscles, as are the others.

The first of this group I would draw your attention to is that disease called nagana, or the tsetse-fly disease. This fly renders thousands of square miles of Africa uninhabitable. No horses, cattle, or dogs can venture, even for a day, into the so-called "fly country." Now what was our knowledge of this disease ten years ago? At that time it was thought that the tsetse-fly killed animals by injecting a poison into them, in the same way as a snake kills its prey. Nothing was known as to the nature of this poison in 1894. In 1895, on account of serious losses among the native cattle in Zululand from this plague, the then Governor of Natal and Zululand, Sir Walter Hely-Hutchinson, started the investigation of this disease. The result of this was the discovery that tsetse-fly disease was not caused by a simple poison elaborated by the fly, as formerly believed, but that the cause of the disease was a minute blood parasite which gained entrance to the blood of the

animals. This parasite is known by the name *Trypanosoma*, which signifies a screw-like body.

Ten years ago two species only had attracted much attention—one living in the blood of healthy rats, discovered by Surgeon-Major Lewis in India; and the other, a trypanosome, found in the blood of horses and mules suffering from a disease known in India as "surra." As the result of this investigation in Zululand, which lasted two years, it was proved that a species of trypanosome was undoubtedly the cause of the death of the horses and cattle struck by the fly, and that the tsetse-fly merely acted as a carrier of this blood parasite.

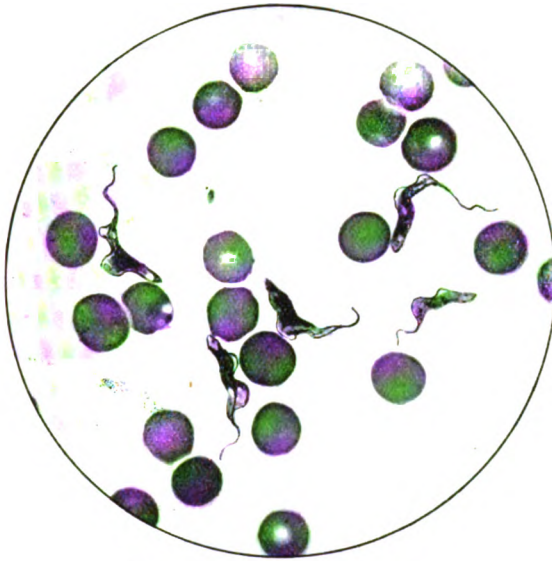


FIG. 5.—*Trypanosoma brucei*.

Here is a representation of the trypanosome of nagana. These trypanosomes consist of a single cell; are sinuous, worm-like creatures, provided with a macronucleus and a micronucleus, a long terminal flagellum, and a narrow fin-like membrane continuous with the flagellum and running the whole length of the body. When alive they are extremely rapid in their movements, constantly dashing about, and lashing the red blood corpuscles into motion with their flagellum. They swim equally well with either extremity in front. These organisms multiply in the blood by simple longitudinal division, and often become so numerous as to number several millions in every drop of blood. They are sucked,

along with the blood, into the stomach of the fly, live in the alimentary tract for several days, and, when the fly has its next feed on an animal, take the opportunity of gaining access to the blood of the new host and so set up the disease.

Here is a representation, natural size, of the tsetse-fly (fig. 6). The wings have been separated in the second figure to show marking on back of abdomen.

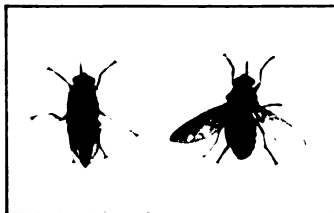


FIG. 6.—*Glossina morsitans*.

Experiments were made which showed that the fly could convey the parasite from affected to healthy animals for at least forty-eight hours. It is a curious fact that among all the blood-sucking flies the tsetse-fly alone has this power, and up to the present the cause of this has not been thoroughly cleared up.

Not only was it found that the tsetse-flies could convey the disease from sick to healthy animals, but it was also proved that the wild tsetse-flies brought from the "fly country" and straightway placed on healthy animals, also gave rise to the disease. The question then arose as to where the tsetse-flies living in the "fly country" came by the trypanosomes. There were no sick horses or cattle in the "fly country." Investigation brought to light the curious fact that most of the wild animals—the buffalo, the koodoo, the wildebeeste—carried the trypanosomes in small numbers in their blood, and it was from them that the fly obtained the parasite. The wild animals act as a reservoir of the disease. The trypanosome seems to live in the blood of the wild animals without doing them any harm, but when introduced into the blood of such domestic animals as the horse, the dog, or ox, it gives rise to a rapidly fatal disease. The discovery that the wild animals act as a reservoir of the disease accounted for the curious fact that tsetse-fly disease disappears from a tract of country as soon as the wild animals are killed off or driven away.

In 1895, the living trypanosome which causes the tsetse-fly disease was sent to England in the blood of living dogs, in order that it might be studied in the English laboratories. These trypanosomes have been kept alive ever since by passage from animal to animal, and have been sent all over Europe and America, so that our knowledge of this kind of blood parasite has rapidly grown.

Koch, in a recent address, says that our knowledge of protozoal

diseases is based on three great discoveries—that of the malarial parasite, by Laveran; of the *P. bigeminum*, the cause of Texas fever or redwater in cattle, by Smith; and, lastly, this discovery of a trypanosome in tsetse-fly disease.

We may therefore, I think, congratulate ourselves on the growth of our knowledge of this great stock disease during the last ten years.

Since 1895 many other trypanosome diseases have been discovered in all parts of the world. The latest and most important of these is one which affects human beings, and is known as "Sleeping Sickness."

This sleeping sickness, which occurs on the West Coast of Africa, particularly in the basin of the Congo, has within the last few years spread eastward into Uganda, has already swept off some hundreds of thousands of victims, is spreading down the Nile, has spread all round the shores of Lake Victoria, and is still spreading southward round Lakes Albert and Albert Edward. The disease is in all respects similar to the nagana or tsetse-fly disease of South Africa, except that it is caused by another species of trypanosome, and carried from the sick to the healthy by means of another species of tsetse-fly—*Glossina palpalis*.

Austen, of the British Museum, has prepared a map (fig. 7) showing the distribution of tsetse-flies throughout Africa, on which it is shown that these flies extend from Lake Victoria down through Central Africa, past Lake Tanganyika to the Zambesi.

It is therefore not at all improbable that this human tsetse-fly disease may spread southward through the various fly districts to the Zambesi, and may even penetrate as far as the fly districts of the Transvaal and Zululand.

I am sorry to say that, in spite of innumerable experiments directed towards the discovery of some method of vaccination or inoculation against these trypanosome diseases, nothing definite, up to the present time, has been discovered. At present there does not seem to be any likelihood that a serum can be prepared which will render animals immune to the tsetse-fly disease. In the same way it has also been found impossible, up to the present, to so modify the virulence of the trypanosome as to give rise to a modified, non-fatal form of the disease. Again, all attempts at discovering a medicine or drug which will have the power of killing off the parasites within the animal organism, without at the same time killing the animal itself, have not as yet been successful, although some drugs, such as arsenic, have a marked effect in prolonging the

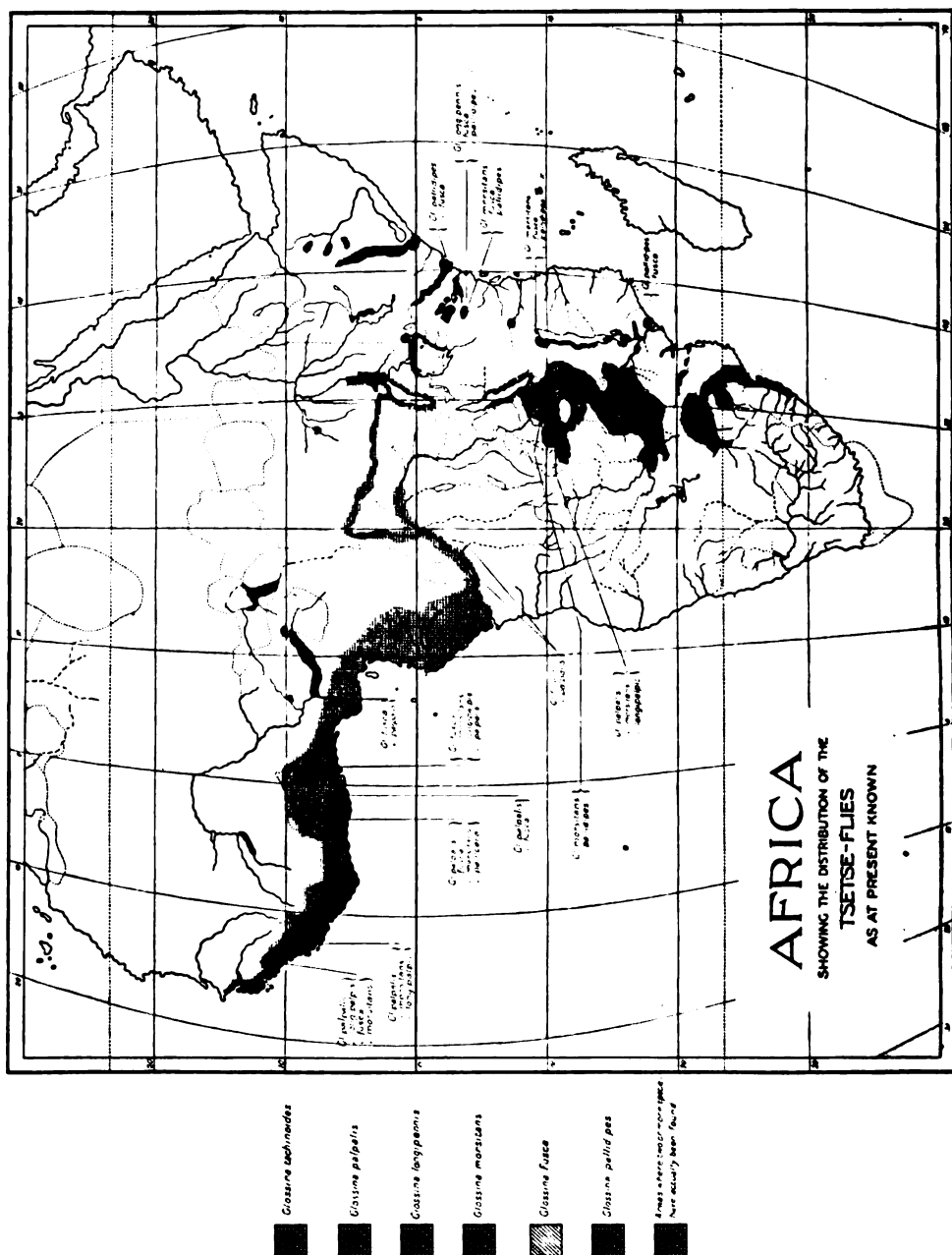


Fig. 7.

life of the animal. As nagana is fatal to almost every domestic animal it attacks, it seems very improbable that there is much chance of cultivating an immune race of horses, dogs, or cattle, which will be able to withstand the action of the parasite. It is quite evident that if an acquired immunity of this kind could be brought about, such a race of immune animals would now be found; but, as a matter of fact, there are no horses, dogs, or cattle in the "fly country." In other protozoal diseases, such as the Piroplasmata, this acquired immunity seems to come about fairly readily.

To sum up, then, the increase in our knowledge of tsetse-fly disease during the last ten years, we may say that we have discovered the cause in the shape of the small blood parasite *Trypanosoma*; we have found that the reservoir of the disease exists in the wild animals, and that we can blot out this disease from any particular tract of country by the simple expedient of destroying or driving away the wild animals. We still have no means of preventive inoculation or successful medicinal treatment in this disease.

(2) *Trypanosomiasis of Cattle.*

This disease seems to be widespread over all South Africa. It cannot be said to be of much practical importance, as the infected cattle do not seem to be seriously affected by it. It is caused by a species of trypanosome remarkable for its large size, which was discovered by Dr. Theiler some years ago, and named *T. theileri*.

Dr. Theiler states that it is conveyed from animal to animal by the common horse-fly, *Hippobosca rufipes*.

This, then, is a short account of the trypanosome diseases which affect South Africa.

Of late years the tsetse-fly disease has become of less practical importance to the Transvaal, from which it has practically disappeared. This is due to the disappearance of the game, killed off by rinderpest; but with the preservation and restoration of the reserves with big game the disease is certain to reappear. Why the fly should disappear with the game is not known.

(To be continued.)

THE INTERNAL ANATOMY OF STOMOXYS.¹

BY THE LATE LIEUTENANT F. M. G. TULLOCH.

Royal Army Medical Corps.

THE dissections of the local variety of *Stomoxys*, which form the subject of this Note, were made at the suggestion of Professor Minchin, during his direction of the Royal Society's Commission on Sleeping Sickness in Entebbe, Uganda. The main object was to furnish some comparison between the internal anatomy of *Stomoxys* and that of *Glossina*, and the following Notes are based on Professor Minchin's description of *Glossina palpalis*.

Complete digestion of the human trypanosome seems to occur in forty-eight hours, in the alimentary canal of *Stomoxys*; but Lieutenant Gray, R.A.M.C., has found a limited percentage of these *Stomoxys* to be infected with a *Herpetomonas*.

I am much indebted to Professor Minchin for advice and assistance at every turn, without which these notes could not have been completed.

Digestive System.—The œsophagus emerges from the chitinous pharynx (which, with the mouth parts, has been described by Hansen) as a flattened tube, which gradually narrows and becomes cylindrical, running at first upwards and then backwards to reach the brain. The connectives of the brain are more vertical than in *Glossina*. On emerging from their constriction the œsophagus dilates gradually, and runs down to enter the ventral aspect of the proventriculus, which lies in the anterior third of the thorax.

The proventriculus is a mushroom-shaped viscus with a thickened border, and lies with its convexity pointing upwards and slightly forwards. Except from the inversion of its lateral edges, which gives to the proventriculus of *Glossina* a characteristic outline, the corresponding structure in *Stomoxys* is very similar in every way. The œsophagus enters the proventriculus a little in front of the centre of its concave ventral surface, and the duct of the sucking stomach running up from below appears to enter with it, though in reality it enters separately at a point immediately behind. As in *Glossina*, the œsophagus and the duct of the sucking stomach are in the same line.

The thoracic intestine arises from the convex dorsal surface of

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the proventriculus, at a point posterior to the entrance of the œsophagus on the ventral surface. From its origin the intestine runs down into the abdomen of the fly as a narrow tube of uniform diameter, until it reaches nearly to the lower border of the sucking stomach. At this point it dilates to several times its former diameter, its wall, at the same time, becoming thinner.

The abdominal intestine is proportionately shorter, less coiled, and more distensible than in *Glossina*; it is about three times as long as the fly itself. The dilated portion of intestine has three simple coils which lie superposed in the middle part of the abdomen, and then gradually narrows, continuing as a uniformly narrow tube down to the rectum. The narrow lower intestine has variable bends in its course, but is not coiled.

The rectum is a dilated cone-shaped portion of the intestine, the apex of the cone being towards the anus. Its walls are transparent, and through them are readily seen four long trumpet-shaped papillæ, the narrow ends of which are inserted towards the anus. A single trachea enters the base of each "gland." Below the apex of the dilated cone the rectum is continued to the anus as a short narrow tube.

In the female this terminal portion of intestine runs within the ovipositor, the anus being situated between the last segment of the ovipositor and the terminal plate. In the male the ejaculatory duct passes over it dorsally from left to right, and runs anteriorly to enter the penis. The appendages of the alimentary canal are the Malpighian tubes, the sucking stomach, and the salivary glands. The Malpighian tubes arise from the narrow lower intestine. The proctodæum, between their origin and the anus, comprises in length about one-fifth of the abdominal intestine. At their point of origin the intestine has a shallow linear constriction.

Two tubules arise on each side from a short common tube, and all four tubules are approximately of the same length. The two tubules arising from one side have thickened terminations, some four times greater than a salivary gland, and these thickened endings lie in the pericardal sinus. The tubules of the other side are of the same thickness throughout, and their ends lie amid the fat-body of the lower abdomen. Microscopically the tubules are of the usual type.

The sucking stomach is a thin-walled sac made up of one layer of flattened cells with occasional strands of unstriped muscle. It ends at the waist in a very fine duct which runs up ventrally to the thoracic intestine and enters the proventriculus immediately behind

the opening of the œsophagus. The alimentary canal and the ducts in the thorax lie in contact with each other in a narrow space between the lateral masses of thoracic muscles.

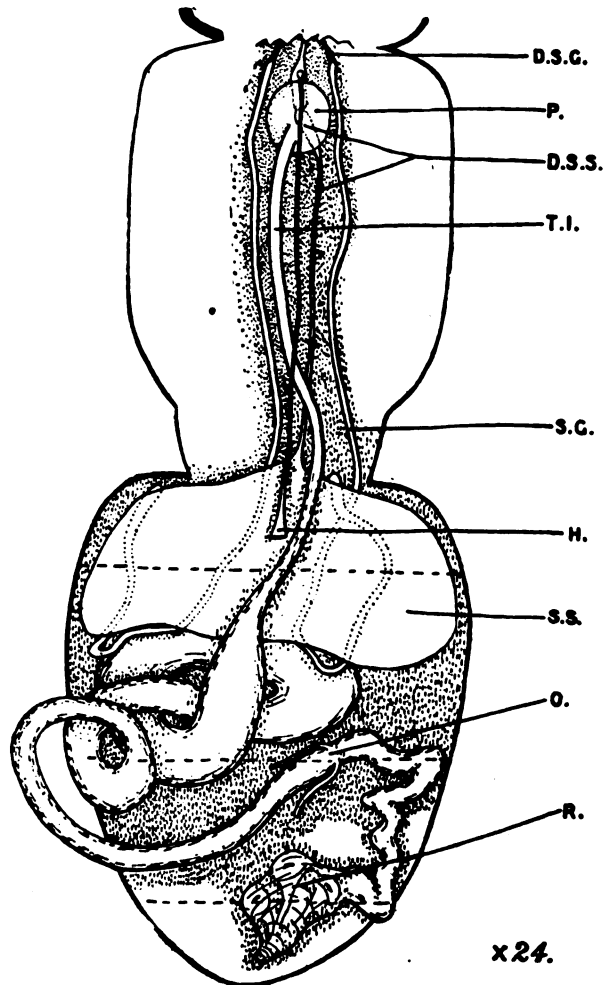


FIG. 1.—Alimentary Canal of *Stomoxys*. Dorsal view. The thoracic muscles were removed, and the structures in the thorax separated and spread out, though their relative positions are otherwise maintained. In the abdomen the position of the coils of intestine has been very little disturbed. P., proventriculus; T.I., thoracic intestine; R., rectum; D.S.G., duct of salivary gland; S.G., salivary gland; S.S., sucking stomach; D.S.S., its duct; O., point of origin of Malpighian tubes; H., the dorsal blood vessel cut short at the heart.

The salivary glands are partly thoracic and partly abdominal. They are comparatively shorter and thicker than in *Glossina*. In

the abdomen they are ventral to the sucking stomach, and from a dorsal view only a knuckle of gland is exposed at the lower border of this viscus.

The slightly bulbous ends of the glands lie under the upper border of the sucking stomach, and are found by following up the outer limb of the exposed angle of gland. Except for this angular bend the glands are straight in their whole course, and even when this is pulled out, they are not long enough to reach the hinder end of the fly. The salivary glands run up through the waist of the fly on either side of the duct of the sucking stomach and ventral to the intestine, and continue with the same thickness to the front of the thorax. At this point, in the neck of the fly, the glandular portion ceases abruptly, to be continued as a very fine narrow duct.

At first this duct is made up of small flattened cells, but it almost immediately acquires the structure of a small trachea, becoming chitinised and having similar annular thickenings. At the base of the brain the two ducts join and continue as a single duct on the ventral surface of the chitinous pharynx, inside the transparent membrane which wraps it round. The dilatation in the common duct which Hansen has described and which he regards as a storage chamber for the secretion, occurs about half-way in the length of the common duct. The point of entrance of the duct into the proboscis has been described by Hansen.

Nervous System.—This consists of the brain and the thoracic ganglion, with the nerves arising from them. The nervous system was not dissected in great detail, but the following nerves were traced as described. The thick nerve to the ocelli arises from the upper part of the back of the brain. The stout nerves to the antennæ arise from the front of each cerebral ganglion.

On either side of the front of the brain below the nerves to the antennæ arises the slender pharyngeal nerve trunk, which shortly divides into three. The outermost of these three branches divides into two, one filament supplying the depressor muscle of the pharynx, which arises from the postero-superior process, and the other running down inside the pharynx in close relation to its chitinous wall. The middle division of the pharyngeal nerve joins its fellow of the opposite side on the wall of the œsophagus as the latter enters the pharynx, the common trunk thus formed splitting into four branches to the intrinsic muscles of the pharynx. The innermost branch of each pharyngeal nerve joins a slender nerve arising in the middle line. The nerve thus formed supplies the pharyngeal muscles, but was not traced in detail.

The brain is connected with the thoracic ganglion by the connectives between which passes the œsophagus, and which join after this to form a long connecting band as in *Glossina*. The thoracic ganglion is somewhat pear-shaped, and is supported by the internal chitinous skeleton of the thorax, from the surfaces of which arise the wing and leg muscles. Six pairs of nerves arise from the thoracic ganglion and supply the thoracic muscles.

The abdominal nerve trunk continues from the posterior part of the ganglion running down in contact with the abdominal wall. It gives off three fine branches, which supply the abdominal muscles, and ends in the third segment of the abdomen by dividing into three. Each of these branches again divides to supply the generative organs, the outer two running to the ovaries or testes, and the middle one to the muscles of the ovipositor or penis.

Circulatory System.—This consists of the heart and its continuation, the thoracic aorta. The heart is a tubular organ of the same type as in *Glossina*, with chambers, ostia and alary muscles. The wall, too, is composed of similar giant cells. Though several stained preparations were made, it was impossible, owing to the fat body which obscured all detail, to count the chambers and cells in the heart wall. They seemed, from a comparison of all the preparations, to be reduced in proportion to the smaller number (four) of abdominal segments possessed by *Stomoxys*.

The dorsal aorta consists of paired cells, as in *Glossina*, and runs up on the dorsal surface of the intestine to end on the œsophagus in a similar mass of cells. On the surface of the proventriculus, to which it is bound down, it becomes expanded and flattened, narrowing again to its termination.

Male Generative Organs.—These are comparatively simple. The testes are a pair of smooth, oval, orange-brown bodies, with a shallow equatorial constriction. Their colour is due to a pigmented coat, as in *Glossina*, but there is apparently not the same tubular structure.

From the lower end of each testis arises a very fine duct, short and straight, which runs down to join the duct of the opposite side as the upper limbs of a Y. From this junction an exceedingly short length of common duct runs into the bulbous upper end of a tubular organ, which would seem to function as a vesicula seminalis.

This vesicula seminalis is a flexible tube, often lying with two U-shaped bends in its course. At its upper it is bulbous, gradually narrowing below this to end as an ejaculatory duct, which crosses

the rectum dorsally from left to right, to enter the penis in front of it; it does not thus encircle the rectum, as in *Glossina*. The hypopygium and penis are of the same type as in *Glossina*.

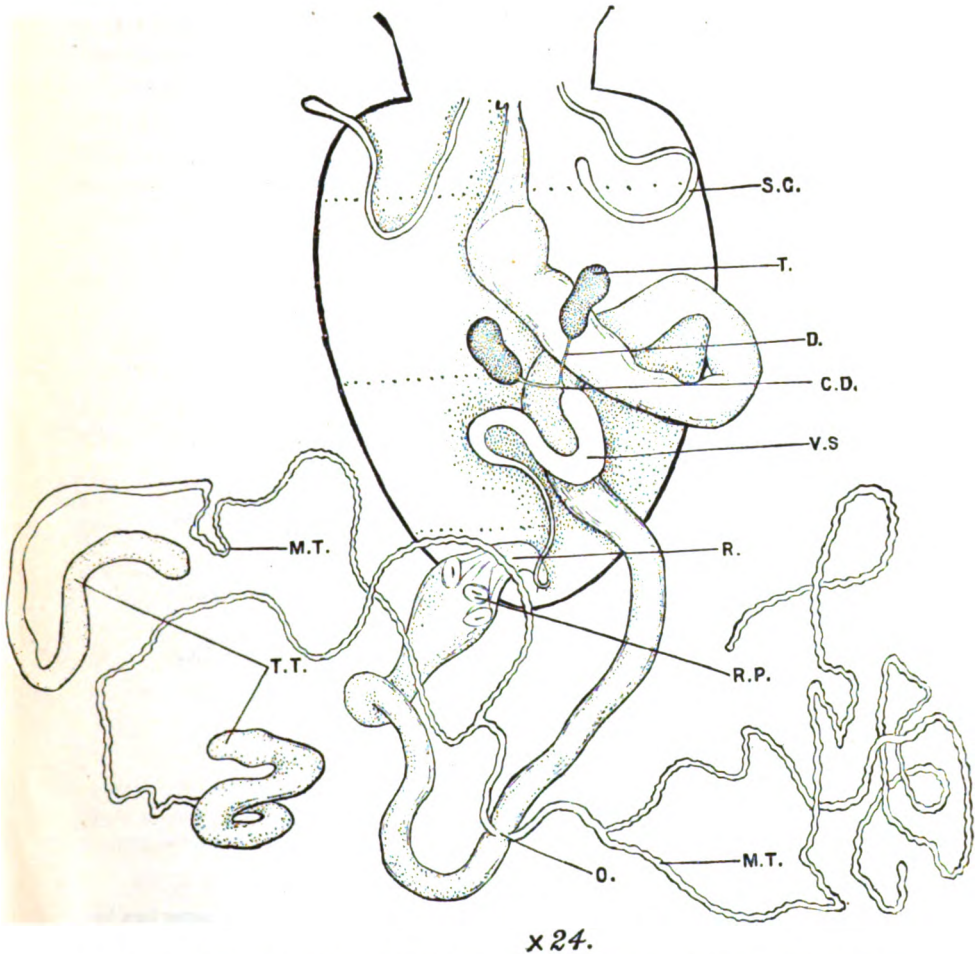


FIG. 2.—Male Generative Organs of *Stomoxys*. Alimentary canal dissected out to show Malpighian tubes. Dorsal view. S.G., salivary gland; O., origin of Malpighian tubes; M.T., Malpighian tubules; T.T., thickened terminations of the tubules of one side; R., rectum; R.P., rectal papillae, three of the four are seen through the transparent rectal wall; T., testis; D., duct of testis; C.D., common duct; V.S., vesicula seminalis.

Female Generative Organs.—The sex of a *Stomoxys* can be easily ascertained by inspection of the hind end of the abdomen; but, unlike *Glossina*, the scutellar bristles are of the same length

in both sexes. The female generative organs are of the house-fly type. There are two ovaries, each consisting of some sixty ovarioles. The ovary is moored to the body wall by a profusely branching trachea, which arises from the pleural space, and ramifies among the ovarioles. In the natural position the ovaries lie with the long axis of the ovarioles pointing upwards towards the dorsal surface. Each ovariole contains never more than four ova in various stages of development.

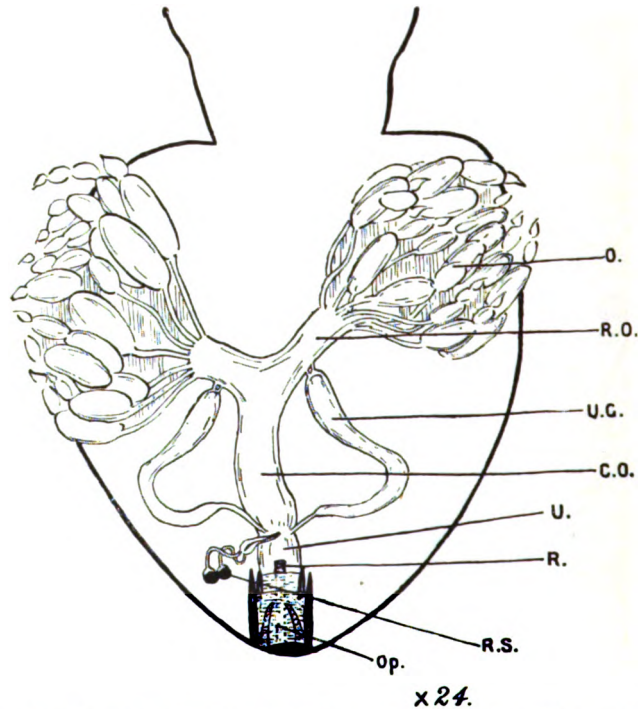


FIG. 3.—Female Generative Organs. The natural position of the parts has been considerably altered for the sake of clearness. Dorsal view. O., ovary; R.O., right ovariole; C.O., common oviduct; U., uterus; O.P., ovipositor; U.G., uterine gland; R.S., receptacula seminis; R., terminal position of rectum cut short above.

The ovaries vary in size according to the degree of maturity of the lowest ova. In some flies they occupy more than half of the whole abdominal space. The ovarioles open into a wide tubular duct, which joins its fellows from the other ovary like the upper limbs of a Y. As a result of this junction is formed the

common oviduct, which runs down, forming a long third limb to the Y. Below the attachment of the uterine appendages the oviduct continues as the uterus.

The appendages consist of the uterine glands and the receptacula seminis. The uterine glands are two rather stout tubular organs, with slightly bulbous extremities. The bulbous end is firmly joined to the lateral oviduct by a very short double strand of connective tissues. Each gland ends in a short, fine duct, and these ducts enter separately the shallow constriction which forms the arbitrary division between the oviduct and uterus.

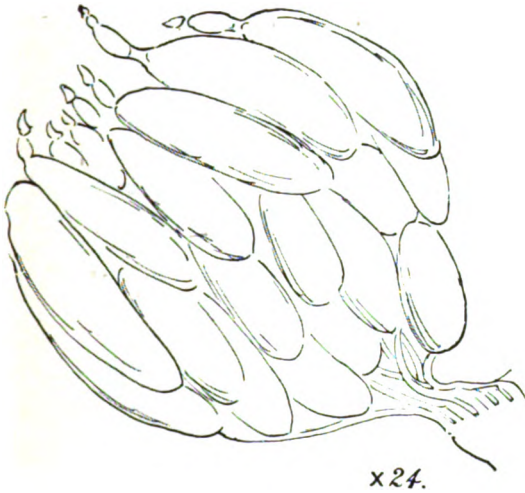


FIG. 4.

FIG. 4.—Mature ovary from another specimen.

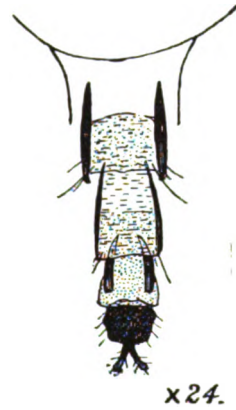


FIG. 5.

FIG. 5.—Ovipositor extended. Dorsal view. The ventral ribs of chitin in the two upper segments are not shown.

The receptacula seminis are two small, black, spherical bodies, each with a cellular socket resembling the fitting of an acorn cup. From this runs a very fine duct, which enters the division between the oviduct and uterus in the mid-dorsal line. The receptacula are attached to each other, but can be separated by dissection. The distal portions of the two ducts are quite separate, but later each duct enlarges slightly, and from this point on to its insertion is closely attached to its fellow. This portion can, however, be separated by dissection, and it is then seen that the ducts are distinct and enter separately.

The uterus is a tube of the same diameter as the common oviduct above, and runs down in the middle line into the ovipositor. The ovipositor consists of three cylindrical segments of thin chitin, which usually lie telescoped inside the abdomen. There is also a single external flap of dark chitin, which lies folded up on the ventral surface of the fly. When the ovipositor is extruded by squeezing the fly's abdomen, the receptacula and uterus are pulled down with it, and can be seen through the transparent walls.

The upper segment of the ovipositor has three narrow ribs of dark chitin in its long axis, two dorsal and one ventral. The next segment is similar. The last segment has two dorsal plates only. The external flap, which is probably the third rib of the last segment, is, roughly, quadrilateral, and has two divergent prong-like processes arising from its free border.

The points of the chitinous ribs which strengthen the segments of the ovipositor project above the upper border of the segment, and to them are attached the muscles of the ovipositor. The narrowed terminal portion of the rectum enters the ovipositor on the dorsal surface of the uterus and runs down to the anal opening between the external plate and the last segment.

HINTS REGARDING THE MANAGEMENT AND USE OF X-RAY APPARATUS.

BY LIEUTENANT AND QUARTERMASTER F. BRUCE.

Royal Army Medical Corps.

(Continued from p. 21.)

BEFORE proceeding to the subject of practical development let us understand, not the theory, but a little about the *rationale* of the process. The light from an X-ray tube in passing through an arm, for instance, meets with varying densities which more or less interrupt its course. The bone tissue checks its passage to a considerable extent, whereas in the softer tissues it meets with comparatively little obstruction on its way to the plate. It is on account of this selective action that we are enabled to obtain an impression of the image formed by the action of light on the silver salt contained in the photographic film. A photographic plate is simply a piece of glass coated on one side with an emulsion containing a silver salt, and which is termed the film. This film is extremely sensitive to both artificial and day-light, and must never be exposed to any other than the ruby-coloured light in the dark-room. On examining a plate after exposure to the X-ray, no visible effect will be discerned on the buff-coloured film, and it is only after applying certain chemicals that the effect becomes apparent. These chemicals are termed the developer.

A developer is composed of several ingredients, and these may be classified as follows:—

Developing Agent.—May be either pyrogalllic acid, metol or hydrokinone. The action of either of these is to render the latent image visible by the help of the other ingredients. To secure strong, vigorous negatives increase the developing agent; for softer results reduce it.

Accelerator.—Generally the caustics and carbonates of soda and potassium. Its functions are to hasten the action of the developing agent.

Restrainer.—Bromide of potassium is now almost universally used, and its function is to control the too energetic action of the developer. As all developing agents by their nature have a strong affinity for oxygen, it is necessary to protect them from deterioration by adding a preservative, such as the sulphite of soda, or the metabisulphite of soda or potassium.

A few remarks regarding the behaviour of the different developing agents may be of some little assistance to the beginner when selecting a developer most suitable for X-ray work. The first object in development should be to produce negatives full of contrast, with detail in even the thinnest parts, hence these points must be kept in view when making the selection.

Pyrogallie acid and metol, by gradually acting on the silver salt throughout the film, have been termed "hard-working developers," and consequently build up negatives full of detail but somewhat lacking in density. Hydrokinone, on the other hand, acting energetically on the surface of the film, produces negatives strong in density but comparatively weak in detail. By a compromise these two in combination have been found to give most satisfactory results by thus incorporating the detail with the density producers. This, at least, has been my experience, and there are many who, to my knowledge, adopt the same method. At the same time, it must be admitted that many operators have produced most satisfactory results by other combinations. Notwithstanding this reservation, I claim for metol and hydrokinone in combination the faculty of being able to produce satisfactory results with a uniformity which makes X-ray work less of an uncertainty in this respect. In the matter of economy metol and hydrokinone, suitably protected by preservatives, can be used again and again until the solution becomes greatly discoloured. Having selected a suitable developer, its functions should be thoroughly mastered, for the greatest percentage of failures have resulted from the eagerness to try all the developers on the market.

The composition of the developer is as follows:—

A.

Metol	1 oz.
Hydrokinone	2 ozs.
Metabisulphite of soda	2 „
Bromide of potassium	1 oz.
Water, to	80 ozs.

The metol and hydrokinone must be thoroughly dissolved in hot water before adding the metabisulphite of soda and bromide of potassium. The solution is then made up to 80 ounces with cold water.

B.

Carbonate of soda	8 ozs.
Sulphite of soda	8 „
Water, to	80 „

N.B.—The water used in every case should have been previously kept at boiling point for at least twenty minutes to drive off all the free oxygen.

For normal exposures make up the developing solution as follows:—

A.	..	..	..	1½ parts.
B.	..	..	..	4 „
Water	..	..	..	4½ „

In X-ray practice the uncertainty as to how much exposure any plate has received renders the idea of a standard solution out of the question, and therefore the above solution could only be used for skiagraphs taken of hands and feet when the exposures, by sufficient care, can be made approximately correct. As a precautionary measure all X-ray plates should be developed tentatively by commencing development with half the amount of B, adding the remainder gradually as occasion may require. In giving effect to this principle the following procedure is recommended, and after a little practice its utility will be certain to be appreciated, as forced development is antagonistic to the production of detail in a negative. Having mixed the solution as suggested, using half the quantity of B, place the other half in a glass on a table near to where the plate will be developed in the dark-room. Remove the plate from the double envelope and place it, film upwards, into the developing dish. Holding one corner of the dish with the left hand pour the developer over the plate in such a manner that the surface is covered at one sweep. The dish must now be gently rocked, due care being taken that the wave which is formed by the rocking motion completely covers the film, otherwise the film will be marked, as a result of unequal development. The dish should be held some distance from the lamp, as even the ruby-coloured light might cause fogging of the film. This precaution is most necessary, for a perfect non-actinic light has not up to the present been devised which will effectually protect during development the extremely sensitive emulsions used in the preparation of X-ray plates. Now carefully watch the surface of the film for the appearance of the object skiagraphed. If after rocking a minute nothing appears, add one more ounce of B to the solution which has been previously returned to the measure glass. On no account must additions be made to a developer whilst it is in contact with the plate. If the exposure had been anything like correct the addition should bring up the object. Presuming that this is so, continue rocking for five minutes with the view of bringing up

detail and add another ounce of B to complete the development. The question of how far a plate should be developed is an extremely difficult one to answer. Using Edwards' Cathodal plates the image should be developed through so that it can be seen distinctly on the glass side of the plate. With a Lumiere plate the appearance on the glass side should be a fairly distinct view of the object and the other parts discoloured. It must always be borne in mind that the end in view when making negatives is the production of prints, hence the density or light-stopping properties in a negative determines how far they shall be successful. With a thin, ghostly-looking negative it is impossible to obtain prints of any excellence. On the other hand, a negative full of detail with strong contrasts and fairly opaque in the darker portions will give a satisfactory reproduction on paper. Of course, a very thin plate can be intensified, and conversely, a very dense one reduced, but of the two evils choose the latter, which is the more easily corrected. Intensification is an exceedingly difficult operation, and rarely succeeds unless in skilled hands. For these reasons I strongly suggest that one should err on the side of over- rather than under-development. The two processes will be explained under another heading. Having decided when to stop development, the plate is removed from the dish and given a fairly good wash under a tap. It is then placed in a solution called the fixing bath, consisting of hyposulphite of soda 6 ounces, bisulphite of soda 1 ounce, and water to make 1 pint. The object of the fixing bath is to remove all the silver from the film which has not been acted upon during the period of exposure and subsequently by the developer. Fixation is complete ten minutes after all white-coloured portions have disappeared from the back or glass side of the plate. This will ensure thorough fixing, for it is more often through carelessness in this respect that the permanency of a negative is affected than from faulty washing. Daylight can now be admitted into the dark-room, as all sensitive matter has been removed from the film by fixing. It now remains to wash the negative to free it from all traces of hyposulphite of soda, which seem to stick to the film like barnacles to the bottom of a ship. To do so efficiently the plate, held vertically by a rack, is placed in a tank under a tap, and the water allowed to run for at least two hours. When the soda is dissolved out of the film it sinks and collects at the bottom of the tank, and unless means are taken to drain away the waste water from the bottom the lower part of the plate will be insufficiently washed. A tank having a syphon answers the purpose admirably, provided a small hole is

made in the upper bend of the pipe to keep the water at one level. In hot weather, when there is a tendency for the gelatine to become soft and blister, wash the plate for a few minutes after fixing and then immerse it in a solution of alum, 2 ounces to the pint of water, allowing it to soak for five minutes before returning it to the washing tank. In tropical climates it is advisable to use a 5 per cent. solution of formaldehyde, which is more powerful than the alum. Immediately before finally removing the plate from the tank, swab the surface of the film under the level of the water by a piece of cotton-wool, to remove all traces of grit or other matter. The plate must now be placed vertically in a rack to dry, and on no account must this be forced, by placing it near a fire, for instance.

Failures in the photographic part of X-ray work are more numerous than in the electrical department. To the beginner a failure should be the means of imparting a never-to-be-forgotten lesson; for why so many people have come to grief is simply because shortcomings have never been reasoned out and accounted for, and they blunder on, trusting to chance eventually clearing matters up—a vain hope. The futility of such happy-go-lucky methods is obvious, and emphasises the fact that to obtain good results the whole procedure must be reasoned out step by step. To assist the novice in correcting his failures a few of the more frequent pitfalls are given, but after a little care and practice recourse to the remedies will seldom be necessary.

Blistering.—This is due, as previously stated, to the gelatine softening by reason of the developing solution being too warm. To provide against this the temperature of the solution and the washing water should never exceed 65° F. It is a good plan to harden the film soon after fixing, either by alum or formaldehyde. If, however, the film shows signs of evident blistering a hardening medium will not eradicate the evil thus formed. In such cases immerse the plate in methylated spirits for a short time, and after a slight wash place it in a hardening bath. In the Tropics a few drops of 5 per cent. solution of formaldehyde added to the developer will assist in rendering the gelatine insoluble.

Negative too Dense.—This condition is easily corrected by using the Howard Farmer reducer. The formula is:—

A.				B.			
Ferricyanide of potassium	..	20 grains.		Hyposulphite of soda	..	..	1 oz.
Water	..	..	1 oz.	Water	..	..	20 ozs.

Take enough of B to cover the plate when laid in a dish, and add a few drops of A. The action of this reducer is very energetic,

and must be very carefully watched. When the plate has been sufficiently reduced, at once remove it from the solution and wash thoroughly. The solution will not keep and should be thrown away.

Negative too Thin, with Little Contrast.—This condition is generally due to either under-exposure or under-development. To make such a negative presentable it must be intensified by some method to increase the contrasts. To carry out this process successfully the film must be thoroughly cleared of all hyposulphite of soda, stains and fog. A slight application of the Howard Farmer reducer will effect the latter, but the washing must be thorough, as the slightest trace of soda present in the film would mar the results.

Prepare the solutions as follows:—

A.				B.			
Perchloride of mercury	..	300 grains.		Liquor ammonia (.880)	..	20 drops.	
Hydrochloric acid	..	30 drops.		Water	..	1 oz.	
Water	..	10 ozs.					

Place the negative, wet, in a dish and pour A over the film, taking care that it is completely immersed. The surface will be seen to slowly turn a whitish colour, but it is the appearance on the back which must be watched. If the negative under treatment be very thin, then the film must be bleached right through, so that the back appears almost white. On the other hand, when only slight intensification is necessary, the bleaching need not be carried quite so far. In any case, after bleaching, the plate must be returned to the washing tank and the water allowed to run for at least half an hour. Again placing it in the dish, B is poured over the film and the former gently rocked. The effect of the ammonia solution is to redevelop or darken the film, and should be continued until the back appears as black as the front. A thorough washing for about half an hour completes the process. A negative can be intensified either before or after it is dry; if the latter, it must first be thoroughly soaked in water for half an hour.

Under-exposure.—Plates which have not received sufficient exposure develop very slowly; parts, in fact, refusing to darken at all. Under these circumstances it is best to dilute the developer in order to coax out all possible detail. Whenever possible it is preferable to make another exposure, as trying to doctor an under-exposed negative is both tedious and uncertain.

Over-exposure.—A plate which has received an excessive exposure flashes up immediately the developer is flowed over the film. The remedy for such is to increase the developing agent and

to decrease the accelerator. Development should be carried to the fullest extent, and over-density can afterwards be corrected by recourse to the Howard Farmer reducer. A well-known maxim is to err on the side of over- than under-exposure.

Before passing to the subject of printing from the negatives, a few remarks regarding the selection of photographic plates may not be out of place. There are many brands of plates in the market, all excellent in their way for ordinary photographic work.

In selecting a plate for X-ray work the chief desiderata are that it should be rich in silver to facilitate the production of a skiagraph with strong contrasts forming the image, and permitting of great latitude in exposure, the last a most valuable consideration. Using such a plate, and with ordinary care, the most perfect results can be obtained with the minimum of trouble. Skiagraphs are in the majority of cases valuable records, a fact which must not be lost sight of when choosing plates.

Printing from the Negatives.—The most simple method, and which will give the best results, is obtained by the use of the ordinary printing out paper, usually known as P.O.P. Personally, I use the Ilford brand, but there are others quite as good. The procedure is as follows :—

The negative, which must be thoroughly dry, is placed in the printing frame and a piece of P.O.P. laid on the top with the film or glossy side against the film side of plate. Before putting on the cover put a piece of clean blotting paper over the P.O.P. to assist in keeping it close to the plate. Carefully clean the glass side of the plate, and set the frame on end facing the light. Avoid printing in direct sunlight, as it is liable to cause mealiness in the prints. Strong diffused light is preferable. Examine the print occasionally in a dim light to note progress of the printing. Only one end of the cover must be opened at a time. When the darker portions have become slightly bronzed it may be taken for granted that the print is finished. Of course, it must be understood that the effect must be carried farther than what will appear on the finished print, as a good deal of it is lost during the toning and fixing processes. Having finished printing, say, eight pieces, $8\frac{1}{2}$ by $6\frac{1}{2}$ inches, arrangements may now be made for finishing them. I should mention that as each print is removed from the frame it must be placed in some receptacle to shield it from the action of the light.

Prepare the following stock solutions :—

A.				B.			
Sulphocyanide of ammonium	..	2	ozs.	Chloride of gold (1 tube)	..	15	grains.
Water, to	..	16	„	Water, to	..	15	drams.

The toning bath is made up as follows :—

A	..	..	..	..	$\frac{1}{2}$ oz.
B	..	..	..	..	2 drams.
Water	..	..	..	..	1 pint.

Carefully filter to remove all impurities. This quantity will suffice to tone eight pieces of P.O.P., each measuring $8\frac{1}{2}$ by $6\frac{1}{2}$ inches.

The prints are put singly into running water and kept moving about until all milkiness in the water has disappeared. This preliminary washing usually occupies about fifteen minutes. The dish in which the prints are to be toned must be very carefully cleaned before the solution is emptied into it; and note that this dish must not be used for any other purpose. Taking four prints from the washing water, immerse them one at a time in the toning bath and keep moving them about to prevent the surfaces sticking together to cause uneven toning. Toning may be said to be complete when, on looking through the prints, the reddish-brown colour has disappeared from all but the darkest portions, and the surface shows a uniform purplish hue. As soon as each is toned it is returned to the washing tank and the whole well washed for at least ten minutes. The fixing bath may now be taken in hand and is prepared by dissolving 4 ounces of hyposulphite of soda in 1 pint of water. It is very essential that toning and fixing be regarded as two distinct operations, as the slightest trace of soda would ruin the toning bath, causing indelible stains on the prints. A safe rule is to finish toning before doing anything at all with the fixing bath. Attention to this rule will save endless disappointment. Fixing is complete in fifteen minutes. As when toning, the prints must be kept moving about to permit equal fixing. The fixed prints are now washed for ten minutes and afterwards immersed in a hardening solution of alum, 2 ounces to the pint of water, to prepare them for the polishing process. The final washing needs careful attention in order to thoroughly eliminate the soda. Two hours in running water will be sufficient, provided the prints are kept moving about and not allowed to collect in a mass on the bottom of the tank.

Polishing the Prints.—The appearance of the finished print is greatly enhanced by a polished surface, so easily accomplished by using P.O.P. Procure some very clean pieces of glass, useless negatives which have been well cleaned are quite suitable, and polish one side with methylated spirit and a clean piece of chamois leather. Next dust a small quantity of French chalk on to the clean

surface and rub it well in with a fresh piece of chamois leather, afterwards holding the plate under the tap to remove any loose portions of chalk. Be careful not to touch the polished surface with the fingers so as to leave a greasy mark. Lay the plate flat down on a piece of blotting paper, and taking one of the wet prints place it on the glass, film side against the polished surface. Using a roller squeegee carefully press the print on to the glass, working the squeegee to and fro several times to give proper contact. Remove the surface water by means of a piece of blotting paper and the use of the squeegee. Stand the glass up in an even temperature, never near a fire, and allow the print to gradually dry, when it will peel off. On no account must the drying process be hastened, as the gelatine will soften and stick to the glass. Neither must the prints be touched until thoroughly dry or attempts be made to force them off the glass. In order to make the polishing process permanent the prints must be backed by pasting drawing paper on the backs when the paper feels dry to the touch. This somewhat retards the drying process, but the extra trouble is well repaid by the extra finish and permanency of the prints. When prints stick to the glass the cause is most generally the want of proper care in preparing the glass supports. It has been stated that ferrotype forms a better support than glass, but my experience cannot bear this out.

(To be continued.)



Clinical and other Notes.

THE ANTISEPTIC PROCEDURE, AND AFTER-TREATMENT OF PATIENTS, AT THE ROTUNDA HOSPITAL, DUBLIN.

BY CAPTAIN R. H. FUHR, D.S.O.

Royal Army Medical Corps.

DURING the past two months' attendance at the above institution, the writer has been much impressed by the care exercised in securing surgical cleanliness. As the uniformly excellent results of the operations performed must be, in a large measure, due to this routine procedure—which can be adapted to the resources of a private house—a short account, emphasising the more important details, may be of interest.

The operating theatre presents no especial features, save that it is not built on an extravagant or expensive plan, and is well supplied with sterilised water. It is divided by a glass screen into a sterilising chamber for instruments, dressings, &c., in which the surgeon with his assistants prepare for the operations, and the theatre proper, with the usual north light and two stands in tiers for the use of visitors, placed close to the windows. The rooms communicate also by a slide window, through which redisinfected instruments can be passed. White linen coats, supplied by the institution, must be worn by all visitors. The theatre is prepared the previous evening by allowing a mixture of 8 ounces of formalin and 10 ounces of water to gently simmer away for six hours, all apertures having been closed. The operator and assistants prepare their hands in the following way: (1) Careful scrubbing with a boiled nail-brush, soap and hot water; (2) rinsing the hands in a solution of biniodide of mercury in methylated spirit (1 in 1,000), 70 per cent. to 30 per cent. of water; (3) rinsing the hands in pure methylated spirit; (4) pulling on boiled "film" indiarubber gloves. The rinsing of the hands in spirit prevents the roughening of the skin and the painful action of the mercurial lotions when gloves are worn, the spirit washing off the biniodide solution, hardening the epithelium, and acting as a lubricant in slipping on the gloves. Further, this procedure has been proved, by frequent bacteriological examinations, to have rendered the skin sterile for operations lasting even a couple of hours. All danger of an accidental prick, or tear of the gloves, and infection of the wound by the hands is thus disposed of. The gloves cost three shillings per pair, and will stand frequent boiling. Sterilised Bergman's coats, over boiled rubber aprons, and sterilised round linen caps with fine "lawn" bags covering the nose, mouth and chin, are also worn. The bags, which are not soaked in any antiseptic, act as a trap for the moisture of the breath and saliva. Experiments with culture plates prove that they render the

breath practically sterile. For a like reason a shield, made of a sterilised towel on a semi-circular wire frame, keeps the anæsthetist's and patient's breath from the abdomen, which is the site of the major operations performed at the Rotunda. The theatre windows are kept slightly open, in order to waft the germs exhaled by the visitors on to the moist floor.

The patient is prepared on the evening preceding the operation by a hot water bath and gentle scrubbing with "monkey brand" soap, followed by carbolic soap, and then dried. The abdomen is covered with a pad of sterilised lint soaked in the bin-iodide and spirit lotion, fixed on by a sterilised binder. When anæsthetised and in the operating theatre, this pad is removed, the abdomen swabbed with æther, then with bin-iodide and spirit lotion, and finally painted with a saturated solution of picric acid in methylated spirit. A Kocher's sheet is put on, the central slit being adjusted to the site of the operation by stitches and toothed forceps. It will be noted that no hard scrubbing of the skin is permitted, the object aimed at being the hardening of the epithelium and the disinfection of its superficial layer. Dr. Tweedy holds that hard scrubbing "mechanically injures and devitalises the living epithelium, leaving it in a condition less likely to withstand the attacks of germs," and also, that "it is of little consequence to us what germs may lurk within the deeper recesses of the skin if we can prevent them sweating to the surface." The last step before commencing the closure of the abdominal wound, is to fill the cavity with sterilised normal saline solution. This allows the intestines to float back into place, and further, much lessens the distressing thirst which is so often troublesome after abdominal surgical operations. In closing the wound, three layers are sutured, viz., the peritoneum with No. 2 silk, the rectus fascia with No. 4 silk, and the skin with silk-worm gut. Continuous sutures are used in each case, and the muscle, as a rule, is not stitched at all. Hernia through the wound has not occurred on any occasion so far. The after treatment may be tabulated as follows :—

The raising of the head of the patient's bed on blocks in cases where septic matter may have escaped into the pelvis, and a gauze drain per vagina. Absolute rest and sips of hot water only for the day of the operation and day following. The administration of calomel in one grain doses every hour up to a total of five grains on the day after the operation, the quantity given depending on the thorough purging considered essential ensuing. A tablespoonful of citrate of magnesia is also given, as a rule, six hours after the initial dose of calomel. On the second day after operation, the diet is limited to a mixture of four ounces of milk and three ounces of soda water, in drinks of an ounce and a half every two or three hours. Two cups of tea are also allowed. By the following day a milk pudding, &c., can be permitted, and ordinary diet is gradually resumed. On the seventh day the skin suture is removed, and in the severe major operations the patient is permitted to sit up in bed on the

nineteenth to the twenty-first day and allowed up on the twenty-first to the twenty-eighth day.

In conclusion, the practical training at this large institution is most valuable to those taking up gynaecology or midwifery, and the kindness and help given to students by Dr. Tweedy and his assistants, Drs. Holmes and Dobbin, make the work agreeable and facilitates study. The fees are moderate, and a residential block enables the visitor to reside in the hospital at the small charge of twenty-five shillings per week for rooms, board, &c. A well-stocked library is available to all.

A CASE OF MALTA FEVER WITH ULCERATION OF THE SMALL INTESTINE.

BY LIEUTENANT L. BOUSFIELD.
Royal Army Medical Corps.

THIS case is of considerable interest from two points of view: Firstly, it is stated by the best authorities that ulceration of the intestine in Malta fever is extremely rare; and secondly, on account of the difficulty often experienced in making a differential diagnosis in the early stages between this disease and typhoid fever, a difficulty sometimes insurmountable without the aid of serum-diagnosis. This difficulty was very strikingly marked in the case about to be described, as it would have been almost impossible to exclude typhoid at the *post-mortem* without the subsequent bacteriological examination.

Hughes, in his Monograph, "Mediterranean, Malta or Undulant Fever," states that one of the differences between typhoid and Malta fever is that "there is a total absence of those morbid changes in Peyer's glands so characteristic of enteric fever." On page 169 he describes the appearance of the intestines in fatal Malta fever cases, and mentions patches of congestion as occurring throughout the tract, but states that Peyer's patches are unaffected, except when there is extreme congestion of the surrounding intestinal wall, and he relates that "in no case was ulceration present."

In the *Practitioner* of April, 1888, Bruce described a case which had four ulcers in the small intestine thirty-six inches from the ileo-cæcal valve, three occurring in Peyer's patches.

Now the mortality of Malta fever is low and used to be placed at 2 per cent., now at 3.2 per cent., yet in sixty-two *post-mortems* on this disease Hughes states that only two showed ulceration of the intestine of such a type that the question of enteric could be raised.

During the last five months several cases have come under my observation having more or less profuse hæmorrhage from the bowel, cases which were, clinically, not typhoid, and whose sera did not react to enteric, though they did to Malta fever. One patient had marked

hæmorrhage and passed about a pint of blood in thirty-six hours, and in this case there was no question of enteric. He had been ill about three months, and had run a typical Mediterranean fever course, when his abdomen became more distended than usual, tender and painful, and he passed the blood with a large slough, about one inch long and three-quarters of an inch broad. His serum was positive to Malta and negative to enteric fever, and no piles were present. He made a satisfactory recovery, and so undeniable proof of ulceration was not obtainable, but the amount of blood passed and the presence of the slough strongly suggest ulceration rather than the leaking of blood from a congested mucosa.

The abdominal tenderness and distension so frequently met with in enteric is also extremely common in severe Malta fever cases, and this condition, with the constipation or diarrhœa or alternative of these two conditions, points to the severity with which the disease attacks the alimentary tract, and I believe that ulceration is more common in these cases than is generally supposed.

Since the mesenteric glands are often found to be enlarged, and the *Micrococcus* has been recovered from them, it seems probable that Peyer's patches are enlarged and are early attacked by the micro-organism as in enteric, and that these sometimes enlarge and break down into ulcers, as in the case to be described in detail.

Private A. L. G., arrived in Malta on September 9, 1905, in good health. Though he belonged to the Royal Army Medical Corps he did not come in contact with the patients, as he assisted in the kitchens. He was admitted to hospital on November 22nd, suffering from severe headache pain in the lumbar region, with a temperature of 102·8° F. He stated he had been feeling out of sorts for two weeks, and had been constipated of late. On examination a few râles and rhonchi were detected, scattered throughout both lungs, the abdomen was rather distended, but there were no spots, and the spleen could not be felt; the tongue was covered with a thick, yellowish-white fur. The serum reacted positively to Malta fever, but gave no reaction to enteric. The temperature remained high—103° to 105° F.—with only slight morning remissions, and his lung condition became more pronounced.

The pharynx became intensely red and congested, and there was ulceration of the lips and gums. The sputum was copious, and showed, on microscopical examination, red and white blood cells, mucus, and many cocci. Epistaxis was very troublesome on the second, third and fourth days, but it was not treated as it was thought to be beneficial, owing to the continued high temperature and high tension of the pulse, the arterial walls appearing to be thickened. Ten days after admission albumen ($\frac{1}{13}$) was found in the urine. The patient remained extremely ill and the lungs showed no signs of improvement, but the pulse remained good in spite of the high temperature. The patient was very restless the

last two days, exhibiting muttering delirium. On the twelfth day after admission he rapidly became worse and died early in the evening, the temperature rising just before death to 105.8° F. On the day of death the albumen had increased to about $\frac{1}{10}$.

Since Malta fever cases so closely resemble enteric, or the two diseases may run a concurrent course, a careful watch was kept on the abdomen and stools, but though the abdomen was tumid, yet there were no spots, and the spleen was not felt until the morning of the day of death. Though on two occasions there was slight diarrhoea the stools never had a "pea-soup" appearance, and no blood or sloughs were observed.

At the *post-mortem* morbid conditions were found in the following organs and tissues:—

Lungs.—Very engorged and oedematous, especially at the bases.

Peritoneum.—No peritonitis, but some extensive sub-peritoneal (parietal) hæmorrhages.

Stomach.—Several small sub-mucous hæmorrhages.

Spleen.—Enlarged, very congested, soft and friable. No perisplenitis.

Kidneys.—Acutely congested.

Mesenteric Glands.—Enlarged and soft.

Small Intestine.—Eight definite ulcers situated between eighteen and thirty-six inches from the ileo-cæcal valve. The largest ulcer was 10 mm. long and 6 mm. broad; the smallest 4 mm. by 3 mm. They were mainly opposite the mesenteric attachment; some appeared to correspond to Peyer's patches, others to the distribution of the blood vessels. The margins were raised and infiltrated, the edges sinuous and shelving, though here and there undermined. The bases were not thickened, but the reverse, for in two ulcers the peritoneum and sub-peritoneal tissue alone were left, while in others the muscular coat was exposed. The sub-adjacent peritoneum was healthy, and showed no signs of lymph deposit or of tubercles.

Large Intestine.—Was healthy, save for a sub-mucous hæmorrhage in the sigmoid loop.

All the other organs appeared healthy.

This condition suggested typhoid complicating Malta fever, and so a portion of the spleen, together with some enlarged mesenteric lymphatic glands draining the area of ulcerated intestine, was set aside for bacteriological examination. Captain J. Crawford Kennedy, R.A.M.C., who is a member of the Malta Fever Commission, very kindly made cultures from these organs, and his results are given in his own words.

"*Spleen*.—Pure culture of *Micrococcus melitensis* in great profusion.

"*Mesenteric Glands*.—Six cultures were taken. Two were sterile and the other four contaminated with *B. mesentericus* and *B. coli*. No *B. typhosus* was present. One colony of the *M. melitensis* was obtained from the six cultures."

On the day of death I was greatly struck by the enormous number of micro-organisms passed in the urine, which was collected in a specially cleaned vessel and examined at once. An attempt was made to cultivate the *M. melitensis* from this, and though I obtained two small colonies of a coccil bacillus, which clumped to the serum of a Malta fever patient, yet the evidence that they were *M. melitensis* was not conclusive, and subsequent cultures were not satisfactory. The one motile bacillus isolated did not clump to the serum of an enteric patient.

The clinical appearance of the case and the subsequent bacteriological examination seem to prove that this was probably a Malta fever case presenting ulceration of the small intestine in a situation almost identical with that of typhoid, and I believe the most skilful pathologist would have been unable to state that the ulcers found at the *post-mortem* were not those of typhoid fever.

A NOTE ON THE USE OF LIME JUICE IN ENTERIC FEVER.

BY CAPTAIN E. T. F. BIRRELL.

Royal Army Medical Corps.

My attention was drawn to the significance of certain complications in enteric fever by a case under my care in the Station Hospital, Rawalpindi, during the summer of 1900. The course of the fever had been severe, and marked by a relapse which left the patient in an extremely weak condition. Progress was slow, when, on the fourth day of apyrexia, and while still on a diet of milk and beef tea, he passed frequent small blood-stained stools, containing a small quantity of mucus, resembling the motions of dysentery. The usual remedies failed to check the process, and this additional drain on a system already weakened resulted in death on the third day from the onset of the symptoms.

At the autopsy were seen the ordinary lesions of enteric fever in early repair, and in addition numerous petechial hæmorrhages and ulcers, varying in size from a millet seed to a small pea, scattered generally over the mucous membrane of the lower portion of the small, and of the whole of the large, intestine. The ulcers, being uniformly small, not concentrated on the folds of the mucosa, and showing no tendency to burrow, differed from those described as occurring in ulcerating dysentery.¹ Such appearances are, however, occasionally met with in scurvy,² and it might be assumed that the scorbutic condition had set in from the deficient supply of vegetable salts in a diet so limited, a deficiency perhaps accentuated by the increased katabolism of a prolonged and wasting fever.

¹ Cf. Manson, "Tropical Diseases," first edition, 1898, p. 296.

² Osler, "Principles and Practice of Medicine," fourth edition, p. 823.

Acting on this supposition the gums of all enteric fever cases were examined, and almost invariably, after a week or ten days of milk diet, were found to show a red line along the margins, in some cases even passing on to a spongy condition, these more severe cases frequently showing traces of blood in the stools.

Lime juice (one to two ounces daily) was administered, with the result that the line on the gums disappeared and the tendency to hæmorrhage markedly decreased. This course was accordingly followed as a regular part of the treatment of all enteric fever patients after the first week on milk diet, and continued until a solid diet with vegetables could be taken.

Ordinary lime juice, as used in military hospitals in India, diluted with water and sweetened with sugar, was well borne, but some patients preferred the juice of fresh limes (four to six daily), as being more agreeable. Any depressant effect was inappreciable.

The same practice was carried out in an intractable case of chronic dysentery, on the hypothesis that the hæmorrhage might partly be of a scorbutic nature, the patient having been on a milk diet for a considerable period, and certainly the results of the administration were most satisfactory. The success of this mode of treatment, in my opinion, justifies a more extended use of lime juice in cases where it is necessary to restrict the diet for long to little but milk, especially in prolonged febrile conditions where the additional burden of a scorbutic element may suffice to turn the scale against the patient.

THE SUB-CUTICULAR SUTURE AND LEADEN PLATE, AS USED IN THE ROTUNDA HOSPITAL, DUBLIN.

BY CAPTAIN R. H. FUHR, D.S.O.
Royal Army Medical Corps.

THE sub-cuticular suture was first described many years ago by Kendal Franks, of Dublin, and Pozzi used it with a deeper strand for the tissues beneath the epidermis. This combination of suture and leaden plate is the invention of Dr. Tweedy, of the Rotunda, and as it can be applied to practically all skin wounds with excellent results, the following detailed account is given:—

The wound edges are carefully washed with normal saline solution, all *débris*, blood clots, &c., being removed. A straight needle, threaded with a long silk-worm gut suture, is inserted in such a manner that it enters the skin about a quarter of an inch from the commencement of the incision, and traverses one edge of the wound for half an inch in the deeper layer of the epidermis parallel to, and just beneath, the cut surface. The needle now emerges, crosses the wound at right angles, and enters the opposite edge of the cut, which it traverses in a similar manner for

half an inch. This procedure of crossing and traversing is continued until the end of the incision is reached, when the needle finally emerges a quarter of an inch beyond in a like manner to the initial entry. The wound is again washed with saline solution, swabbed with bin-iodide in spirit (1 in 1,000), and the edges firmly approximated by pulling on the ends of the suture, which must be left long. A flat pad of sterilised lint, wrung out in the bin-iodide lotion, is laid on the wound. Next, a sterilised plate of lead sheeting, about two and a half inches broad and a couple of inches longer than the incision, with holes bored in the median line an inch further apart than the wound length, is threaded with the suture ends and laid on the lint pad. The suture ends are firmly pulled, and, as the lint pad is withdrawn, are tightly tied, so that the plate presses evenly on the wound.

The advantages claimed are: (1) Fine, linear, almost imperceptible scars; (2) rapid union of the skin edges, owing to the even, level pressure of the leaden plate, and also to the sealing of the wound by the lead salt formed; (3) easy removal of the suture (seventh day) by tipping up one end of the plate, and snipping with scissors, when a quick sliding movement of the plate carries the suture out quite painlessly.

In using this combination care should be taken to dry the wound edges well, and to carry the suture at a right angle, or even a little forward, in crossing the wound.

SOME REMARKS ON PROTECTIVE INOCULATION AGAINST MALTA FEVER.

BY LIEUTENANT L. BOUSFIELD.
Royal Army Medical Corps.

SOME years ago an anti-toxin was prepared for Malta fever and was extensively used in Malta, but as the results proved unsatisfactory its use was abandoned. A preventive inoculation by means of an emulsion of dead *Micrococcus melitensis* was attempted in four or five cases some time back at Netley, and I believe the results are recorded in one of Professor Wright's articles, but, unfortunately, I have been unable to come across the article in question, and so have not had the benefit of perusing it.

This communication deals only with the result of the inoculation and the development of agglutinins in the blood of a single case and so is of small value, as time and many inoculations, combined with prolonged residence in Malta, alone can prove whether any temporary or lasting immunity can be gained by this method.

Lieutenant-Colonel W. B. Leishman, R.A.M.C., very kindly supplied me with the material, which was contained in two glass capsules, A. and B., the contents of B. to be used about ten days after A. The material

was prepared in the same manner as that previously employed at Netley ; that is to say, it was made from fresh agar cultures of the *Micrococcus*, emulsified in sterile normal salt solution, and sterilised by heating to 60° C. for twenty minutes, and to prove that sterility was complete cultures were attempted on agar and in broth for four days at 37·5° C. ; the results showed the vaccine to be perfectly sterile.

The two doses supplied were : A. 0·25 cc. of emulsion, containing about 250,000,000 cocci, and B. 0·5 cc. of emulsion, containing about 500,000,000 cocci. The first inoculation was made on September 23, 1905, and the site chosen was the right flank. The syringe (all glass) and needle were sterilised by boiling for ten minutes, and the skin was thoroughly scrubbed with soap and water, followed by a solution of 1 in 40 carbolic. The capsule was washed in 1 in 40 carbolic and the end broken off with sterilised forceps.

There were no symptoms for eighteen hours after inoculation, then slight headache and a sensation of coldness appeared, but the temperature was normal though the pulse had risen to 92. Four hours later the temperature had risen to 101·6° F. with all the usual symptoms of fever. The fever reached 102° F. twenty-four hours after inoculation and reached normal in about forty hours, the pyrexia lasting from eighteen to twenty hours. At the end of the second day the site of inoculation had become red for about an area of four square inches, and contained in its centre an indurated spot about the size of a two-shilling piece, which was not painful but very tender. There was malaise for twenty-four hours after the subsidence of the fever, and after three days health was absolutely restored, except for the tender seat of inoculation and for tender enlarged lymphatic glands in the right inguinal region. From this time onwards the site of inoculation became larger, finally attaining the size of a small hen's egg ; the skin over this swelling became purplish in colour, such as one sees around a chronic ulcer. The swelling was very tender to the touch, and owing to its position was constantly being pressed on by the clothes on every bending movement, and as deep fluctuation was elicited, Captain Riach, R.A.M.C., cut down on it on the fourteenth day after inoculation, and at a depth of about half an inch, through brawny tissue, one or two drops of turbid serum escaped, followed a little later by a larger flow of about a drachm. Unfortunately, being aboard ship, there were no means at hand to examine this material, but it appeared, macroscopically, to be that of a sterile abscess, which, I would suggest, was due to toxins destroying the surrounding tissues. For the next ten days serum was perpetually escaping through the incision, and for the following six days the fluid kept on collecting, taking the first opportunity of any bending movement to break open the wound again. Twelve days after the inoculation the bursa behind each tendo-Achilles became acutely inflamed, the sulcus on either side of the tendon became obliterated, and the part became hot, red, and tender to the touch, rendering

walking painful. This condition only lasted two days, but again appeared on two subsequent occasions at intervals of a few days. Now, on board ship, there was practically no opportunity for violent exercise, and the only exercise indulged in was walking up and down the deck; and these attacks came on without any apparent cause, and must, I think, have been due to the inoculation. About four years previously I had had an attack of bursitis on the left side, but then only after prolonged and violent exercise; further, after arriving in Malta, I have had plenty of violent exercise without any recurrence of the bursitis. If this condition was due to the inoculation, then it is interesting as showing that the toxins, in the absence of the bacteria, may possibly cause inflammation of synovial membranes. The view that this condition was so produced is strongly strengthened by information given me by Captain J. Crawford Kennedy, R.A.M.C., namely, that inflammation of these bursæ is not at all uncommon in Mediterranean cases; and further, in the short experience I have gained of this disease, I have been forcibly struck by the sharp attacks of synovitis that these patients suffer from and by the rapidity with which these conditions pass off, leaving the affected parts apparently as sound as before.

At the moment of writing I have two cases under my care with acute inflammation of the bursa behind the triceps tendon; in one case the inflammation is now rapidly subsiding and has only been present forty-eight hours. Other cases have shown inflammatory conditions of the knee, hip, ankle, shoulder, elbow, phalangeal and metacarpal joints, sacro-iliac synchondrosis, sternoclavicular joints, sheaths of flexor and extensor tendons of the hand, and in none of these did the attack last longer than fourteen days, and in several cases only three or four days, and this in spite of the cases being so severe (hip and knee especially) that, with my lack of experience, I took them to be cases of acute septic arthritis that might require operation at any moment, and yet within a fortnight they were absolutely restored, as far as symptoms and physical examination could determine.

The first opportunity of examining the agglutinating power of the serum was in the Lazaretto, at Valletta, on October 18th, *i.e.*, twenty-five days after the inoculation. An emulsion was made with 0.6 per cent. NaCl solution from a fresh agar culture, supplied me by Captain Kennedy. Dilutions of 1 in 30, 1 in 60, 1 in 120, and 1 in 240 were made and the sedimentation method employed; controls of normal salt solution and emulsion were also put up. After one hour, distinct clumping had taken place in the 1 in 30 and slight clumping in the 1 in 60 dilution; the others had remained uniformly turbid. After twenty-four hours the 1 in 30 showed one big clump; 1 in 60 complete clumping; 1 in 120 distinct, though less marked; 1 in 240, and the controls, showed no signs of clumping. At the laboratory of the Valletta Hospital, on November 27th, *i.e.*, sixty-five days after inoculation, the serum gave

the following results: 1 in 20, 1 in 30 and 1 in 60 marked clumping and practically no free cocci in half an hour; 1 in 120 and 1 in 240 no clumping in half, three-quarters, or one hour. These tests were done microscopically, and the slides with the dilution drops were kept in a covered moist chamber during the waiting time, and the $\frac{1}{2}$ objective was used. Sedimentation tubes of 1 in 30 and 1 in 60 also showed clumps. On February 20th, *i.e.*, 150 days after inoculation, I again tested the serum in the following dilutions: 1 in 10, marked clumping in ten minutes; 1 in 20, distinct clumping in ten minutes; 1 in 40, 1 in 60 and 1 in 120, no signs of clumping in ten, twenty or forty minutes. The emulsion showed no clumps, and the controls showed only free cocci.

Thus, the result of the inoculation, as far as the production of agglutinins is concerned, is very satisfactory, but whether the formation of agglutinins means the production of immunity is quite another matter.

The second dose was not taken on account of a rather severe epidemic of diphtheria on board ship at the time it should have been administered, for at such a busy, anxious period one could not risk being laid up with an attack of fever, or with the possibility of an attack of inflammation or synovial membrane.

This result seemed worthy of being placed on record as so little has been attempted in this direction, and the more one sees of this fever in Malta the more one is forced to believe that the only method of efficiently combating this disease will be by preventive inoculation, for the coccus appears to be almost omnipresent and, in many instances, to have its hold on an individual for weeks, even months, before it causes the sufferer to take to bed, during which period it is probable that the individual is capable of spreading the disease either through his excretions or by the intermediary of biting insects. It is to be hoped that more will undergo this inoculation, as it is only by means of submitting to it that its value in the production of immunity can be estimated. When one considers the great liability to contract the disease when stationed in Malta and the probability that, if the disease is contracted, it means a sojourn in bed of eight to twelve weeks, with a convalescence spreading over several months, then the inconvenience and slight risk of the inoculation pale into insignificance, and would, I am sure, be readily faced by many now resident in Malta, if only it was placed before them in a proper light.

A CASE OF ENTERIC FEVER WITH SPONTANEOUS RUPTURE OF THE SPLEEN.

BY CAPTAIN J. W. WEST AND LIEUTENANT T. S. DUDDING.

Royal Army Medical Corps.

PATIENT was admitted to hospital, Bloemfontein, on February 25th, 1905, complaining of headache, which he had had for two days; his bowels had been opened the previous day. He had had no previous illness during his service.

Condition on Admission.—Temperature 101.4° F., midday, face somewhat flushed, tongue coated with greyish-white fur, no rose spots on abdomen, which was slightly fuller than normal, no marked enlargement of spleen observed. He was given phenacetin, 7 grs., c. caffeine, 3 grs. In evening temperature was 102.0° F., his headache was better, and he said he thought he would be fit to go out on the morrow; as his bowels had not been opened that day, calomel, 3 grs., was given, which was followed early next morning by mistura alba, $1\frac{1}{2}$ ounces; diet: milk, 3 pints, and two bottles of soda water.

On February 26th, temperature in morning, 100.4° F. Patient said he felt quite well and wanted to go out of hospital; bowels unopened, condition otherwise the same. Splenic dulness did not extend below the costal margin. Temperature in evening, 103.4° F.

On February 27th, temperature in morning, 100.2° F., condition unchanged; a simple enema was given resulting in a semi-formed yellowish stool; mistura alba, 1 ounce, was given in the afternoon and he passed a loose dark yellow stool.

On February 28th, temperature was 100.0° F. in morning, tongue drier but still covered with grey fur, abdomen slightly tympanitic, bowels opened once, the motion being loose and light yellow, much more typical of an enteric stool than the previous ones; he was moved from the observation enteric tent into the enteric ward, being carefully carried on a stretcher. His evening temperature rose to 104.0° F., and he was sponged; whenever his temperature was 103.0° F. and over he was ordered to be sponged. During the night he had another stool, loose and yellow.

On March 1st he was given a simple mixture of oil of turpentine, 5 m., t.d.s. His condition was unchanged, his pulse was 80 and minute; a few rose spots were seen on the abdomen.

On March 2nd his condition was somewhat improved, his face paler.

On March 3rd a temperature was 100.2° F.; at 7.30 a.m. temperature was reduced to 100.2° F.; at 8.30 a.m. he had a loose stool, at 8.30 a.m.

he passed another similar stool; at 8.45 a.m. he complained of severe pain in his abdomen and he felt very ill. He vomited for the first and only time, his face became pallid and covered with perspiration, and his temperature subnormal. I saw him at 9 o'clock and he was in a collapsed condition, somewhat restless, and complaining of severe abdominal pain; his pulse was very weak and rapid, his abdomen was tender, distended and tympanitic, the liver dulness being diminished. I asked Captain West to see him with me, and suspecting perforation, it was decided to operate. It was thought advisable to wait for an hour or two to allow him to recover somewhat from his collapsed condition, therefore he was given $\frac{1}{8}$ gr. of morphia, and turpentine stupes to abdomen. His pain was relieved and he became much quieter, and his pulse improved somewhat. At 10 a.m. his temperature was 97.0° F. At 12 noon he was brought into the theatre and Captain West operated upon him.

Case handed over to Captain West.

(Signed) T. S. DUDDING, *Lieutenant, R.A.M.C.*

March 3rd.—At 10 a.m. this morning I was asked to see the case with Lieutenant Dudding. The patient was in a very collapsed condition, sweating profusely, and pulse very weak and rapid. He complained that an hour previously he was attacked by a severe pain in the abdomen and vomited. The pain he described as being in the middle of the abdomen. On examination the abdomen was slightly distended, rigid and very tender. On percussion it was tympanitic all over, and liver dulness practically obliterated. As he was so collapsed it was thought advisable to wait for an hour before operating, and $\frac{1}{8}$ gr. morphia was given hypodermically. At 12 noon, chloroform having been administered, I opened the abdomen below the umbilicus in the middle line. On reaching the peritoneum it bulged into the wound, and on incising it blood gushed out. The whole of the lower part of the abdomen was full of blood and the intestines were floated upwards. No air escaped from the abdominal cavity when the peritoneum was incised. The whole length of the small intestine was examined and no perforation or bleeding point could be found. By this time patient was in an extremely collapsed condition. Strychnine and ether were administered but pulse could not be felt at the wrist. The spleen was suspected to be the bleeding organ, but patient was not fit to stand any more, so the abdomen was washed out with very hot saline solution, to which about 20 m of adrenalin chloride was added. The abdominal wound was closed. Patient was now moribund, so he was not removed to bed, and he died about ten minutes later on the table.

Post-mortem Examination.—In the afternoon I performed a *post-mortem*. The abdomen was found to have several large clots of blood among the intestines and around the splenic area. The abdomen was freely opened so as to expose the spleen *in situ*. It was seen to be very large and to have a rupture about three inches long on the diaphragmatic

surface. On removal it was found to weigh 2 lbs. $2\frac{1}{2}$ ounces, and the capsule was extensively separated by blood clot. The intestines showed seven well-marked enteric ulcers in the small intestine and one very large and deep ulcer in the cæcum. The mesenteric glands were much enlarged, and one on section showed a necrotic patch. The liver weighed 5 lbs. and was normal. Kidneys normal. Right lung weighed $9\frac{1}{2}$ ounces, normal. Left lung $8\frac{1}{2}$ ounces, normal. Heart $11\frac{3}{4}$ ounces, normal. Brain and spinal cord not examined.

Cause of Death.—(1) Enteric fever, (2) spontaneous rupture of spleen and intra-abdominal hæmorrhage.

(Signed) J. W. WEST, *Captain, R.A.M.C.*

In a retrospect of the case one is struck by the apparent mildness of this case and the very short duration of the illness. It is probable that the duration of the disease was longer than the period ascertained from the man's history, viz., eight days; the temperature with its variations pointing to a third week of the disease. On the other hand, the temperature on admission to hospital was lower than it was whilst in hospital.

The absence of any symptoms of illness tended at first to veil the diagnosis. The enlargement of the spleen was in all probability present early, though veiled by the tympanites, and certainly this was the case on the morning of the collapse. And in regard to the symptoms and signs of the collapse, it was impossible to say definitely at first whether this was due to a perforation with its accompanying signs, or to hæmorrhage with or without perforation. The bowels were floated upwards, and it needed very little fluid in the abdominal cavity to convert a mildly tympanitic abdomen into one in which tympanites was well marked. The attack of vomiting, the acute unlocalised pain in the middle of the abdomen, the absence of liver dulness, the rapid, weak pulse, the pallor and perspiration of the face, were all in accordance with the view that perforation had taken place. The only thing that pointed to hæmorrhage was the restlessness, and that was not marked. Dulness in the flanks would have helped one, but this was not present to any marked extent at the period when the man was examined, viz., within twenty minutes of the time that the rupture had apparently taken place.

Further interest lies in the extreme rarity of the condition. Osler states that in 2,000 autopsies made in Munich, only five cases of ruptured spleen were found.

Cultures of the mesenteric glands on agar and gelatine proved sterile.

BY MAJOR R. J. COPELAND AND MAJOR F. SMITH, D.S.O.
Royal Army Medical Corps.

PULSE	RES
101.5	0
104.5	0
98.5	0
102.0	1
98.5	2
102.0	3
98.5	4
102.0	5
98.5	6
104.5	7
98.5	8
98.5	9
98.5	10
98.5	11
98.5	12
98.5	13
98.5	14
98.5	15
98.5	16
98.5	17
98.5	18
98.5	19
98.5	20
98.5	21
98.5	22
98.5	23
98.5	24
98.5	25
98.5	26
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98.5	28
98.5	29
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98.5	31
98.5	32
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98.5	45
98.5	46
98.5	47
98.5	48
98.5	49
98.5	50
98.5	51
98.5	52
98.5	53
98.5	54
98.5	55
98.5	56
98.5	57
98.5	58
98.5	59
98.5	60

The extraordinary thing about this case is that the man has never been out of England. Malarial fever, as far as we know, disappeared from England many years ago. Certainly the disease is quite unknown in Hampshire. The last recorded prevalence in the army at home took place among some soldiers at Tilbury Fort (Army Medical Department Report, 1875, by Surgeon-Major J. G. Faught). Then how did Gunner X acquire fever? He is stationed in Clarence Barracks—new buildings in a large, dry, airy space and not near any water, except the sea, on the Southsea parade. A most careful search of the building, on the first floor of which is situated room 3 in which Gunner X lives, revealed nothing that could throw any light on the cause of fever—that is to say, there were no mosquitoes in the rooms, and there was no standing water about.

There are over a dozen men in the room. It is a curious coincidence that one of them, not long home from abroad, was suffering from fever in May and was taken into hospital on the 15th of that month with tertian fever. He was then found to have many tertian parasites—including gametes—in his blood. On May 24th, this man, Gunner Y, was discharged from hospital, and he returned to room 3. On June 12th, Gunner X was admitted to hospital. Gunner Y says he had no fever after he left hospital. No other fever cases have occurred recently in room 3. The dates of the two cases mentioned suggest that Gunner X got his fever from Gunner Y, but how? The men do not appear to have had any particular communication with each other. We are driven then to the speculation that we have here an instance in which the flea or the bug has acted as transmitter—possibly, but not necessarily, by direct conveyance of fresh blood from man to man. In any case the occurrence opens a wide field for reflection and goes a long way in explanation of the cause of some failures to stamp out fever by destroying mosquitoes. For the mosquito does not seem to have been concerned in this attack of malaria. There is a loophole for possible escape from this conclusion however. Gunner X spent the Whitsuntide holiday with his parents at the Isle of Wight, in Carisbrooke Castle, of which his father was then caretaker during the Deputy-Governor's absence. The first symptoms of illness were noticed eight days after Gunner X's first night at Carisbrooke. Duty at manœuvres and pressure of other work has prevented our making a full enquiry on this point, but one of us (F. S.), paid a brief private visit to Carisbrooke and failed to find evidence of the presence of *Anopheles* or of cases of fever there. The Castle is on a dry hill. Gunner X's father was interviewed and his blood examined with negative result. He stated that he was in India twenty-four years ago, but had no fever either there or on his return. He is a healthy looking man. He said that he is much bitten by gnats sometimes when among the bushes in the grounds. At Carisbrooke midges were found in the garden—probably there are also *Culex* mosquitoes there. Gunner X said he was not aware of having been bitten by any kind of insect either in Carisbrooke or Portsmouth.

Echoes from the Past.

ON THE MEDICAL ORGANISATION OF THE BASE OF OPERATIONS IN WAR TIME.

BY SURGEON-MAJOR G. J. H. EVATT, M.D.

Army Medical Staff.

[Now Surgeon-General G. J. H. Evatt, C.B., A.M.S. (R.).]

(*Continued from p. 84*).

SECTION III.—THE MEDICAL TRANSPORT OFFICER AT BASE.

It is to be borne in mind that the whole of the sick and wounded of the army, amounting in every campaign to thousands of men, have to pass through the base either to reach the base hospital, or to go to the hospital ship, or to be placed on transport ships for England. I maintain that this transport duty is highly important, and that it should be well and thoroughly done is only possible by making definite arrangements beforehand. Say that the railway station from the front is one mile from the base hospital, that the base hospital is two miles from the hospital ship, who is responsible for this conveyance of sick and wounded to both or either of these institutions?

To expect the sanitary officer, of whom we have just treated, to do this work is to ask for an impossibility, unless he completely neglects his sanitary work.

The sick transport at the base needs not only a special officer, but it needs special men under his command. No officer and no man is to-day specially told off to this duty, save only the sanitary officer, who is already overworked, and who has no time for this trying duty. Can the base hospital staff do it? I say no, certainly not. Their duty ends at the hospital, and they should not leave its enclosure. Can the hospital ship staff do it? Certainly not again. Has the base P.M.O., then, no one to do this work? The answer is, He has no one whatever.

I maintain that if this duty is to be done well we need a bearer company at the base, and we need all the officers of its staff for duty with the Medical Staff Corps Dépôt.

In addition to all existing medical staff at the base, I would add on one bearer company, and make it not only the transport company, but also make it and its officers and men the dépôt of the

Medical Staff Corps in the campaign. To-day the P.M.O. of the base is responsible for the pay, clothing and equipment documents of the whole of the M.S.C. men in the army corps. I maintain that by this rule we overload the P.M.O. with a mass of entirely petty detail, and that he could not possibly do the work of the army corps and the base, and not break down. Further, the registrar of the base hospital is ordered to take over all other documents of the M.S.C. men in the army corps. We then have the documents divided between two different people, and in the end both would be overworked. We must simplify all this, and how? By posting a bearer company to the base, and utilising it and its officers and men as a *dépôt* for the M.S.C., as well as for the transport duties. The need of a M.S.C. *dépôt* at the base is at once admitted. Men of the corps and officers arriving out have now no place to be posted to except the base hospital. I say that to post all these officers and men to the base hospital is to entail a great amount of disturbing work of the base hospital staff, and that it is unfair on them to do this. The true way is to give this duty over to the medical officer commanding the bearer company proposed for the base. He can act as transport officer for the base, one of his officers in the company can assist him in this onerous duty and the other act as adjutant and caretaker of all documents belonging to the M.S.C. of the army corps, while the quartermaster would be in charge of all the clothing, documents, &c., and of the whole of the M.S.C. in the field. To this *dépôt* also the paymaster M.S.C. would be attached, and all would work very easily. It would free the base P.M.O., free the base hospital registrar, provide for all the sick transport at the base, furnish fatigue parties for the medical store *dépôt* and the medical department generally. From it all men going to England would embark. To it all M.S.C. men arriving out would be posted. To it all men arriving from the front would be attached. With it would remain all the heavy kit of the M.S.C. in the field, and to it all young officers would be posted for food and shelter before going up country. Every one says that this company will fill up a want, and we know well that the transport work at the base is heavy, important, and now completely unprovided for. The medical transport officer then, whoever he may be, is absolutely needed. He is responsible for two things, viz., the receiving over of all sick and wounded at the railway terminus of the line from the front, the conveying them and handing them over to the base hospital, and further, the careful embarkation of the sick and wounded on board the hospital ships and sick transport ships for England. This work I call onerous in the last degree.

The officer needs to have at the railway terminus an office labelled "Medical Transport Office." Here he keeps any needful papers, some stimulants, some medicines for urgent cases, and here he posts a sergeant's party who are always on the spot to receive news of sick arrivals and to afford aid to small parties arriving. This N.C.O. and his three or four men are to be detached from the bearer company at the base just referred to. One of them, acting as cook, has coffee and hot soup ready for all sick convoys arriving from the front. When a train is expected a messenger is despatched to the bearer company camp to call up the fatigue parties and their waggons. The sick are then handed over from the waggons to the base hospital.

If needed, the bearer company at the base mans the ambulance train as far as the first etappen post up the line.

For the removal of sick from the base hospital to the ships, a like provision is needed. An office near the pier, distinguished by a red cross flag and labelled with a large sign-board, "Medical Transport Office," is needed. Tents do very well for this purpose. A sergeant and a stretcher party of four men are always on duty here, one man acting as cook to have soup and hot coffee ready for the sick.

If possible a special pier is built for the embarkation of sick and wounded. This is most desirable and will one day be the rule.

On the pier, or near the office, should be painted up clearly the hours at which sick will be embarked, generally every morning and every evening. This can be arranged by reference to the M.O. of the base hospital and the hospital ship.

Special shelter is needed near the pier to shelter the sick and wounded from sun and rain. Tents will do for this until a shed is built. Coffee, soup and urgent medicines may be needed at this place. Stretchers should be ready, as at any time sick may arrive who need such help.

A code of signals to the hospital ship are needed, referring to sick being ready to embark, convalescents to disembark, &c. Steam launch wanted, and such like.

If the ship lies any distance out a flag staff and a signal book are needed, also signalling flags. A telephone to the ship is very useful.

To every hospital ship at least two steam launches are needed to tow off the sick boats.

The P.M.O. of the base generally needs a steam launch, in addition, to do his duty thoroughly.

We still need special boats to convey sick men to the ship. Horse boats as now used are comfortless and shelterless. These boats should be part of the hospital ships equipment. A pattern boat is to be found in use between Haslar hospital and the men-of-war in Portsmouth harbour. At the ship's side a pontoon is needed for use as a floating pier beside the ship. The sick are lifted on to it and then carried in through a large receiving port.

Specially good stairs or companion ladders, wide enough to allow a sick man to be carried up, are needed for the hospital ship.

The duty of the medical transport officer and his men ends when he hands over the sick to the medical officer of the hospital ship. When the boats are returning to the shore they take back all convalescents to the base. By definite hours fixed with regard to all concerned and published in orders, comfort is secured. The ten ambulance waggons of the first line of the bearer company with transport complete are needed with the company at the base. These waggons can be utilised for carrying medical stores at the base when not otherwise needed.

I think that no person who has studied this subject but will agree that if to-day we have no unit allowed for this base transport work it is a distinct weakness in our war system. The plan I propose here is simple, and it would, I claim, be a distinct gain to the sick and wounded.

SECTION IV.—THE MEDICAL OFFICER IN CHARGE OF THE BASE STAFF.

This officer is not allowed for in the existing scheme of medical arrangements at the base of operations, but I do not see how the work there is to be done without him. The happy-go-lucky system is to say, "Oh, anybody who is sick must get help from the base hospital, or from the hospital ship." To both these proposals I say no. In the first place, the base hospital may be a mile or more away from the base offices and camps. Again, there is no allowance made in the base hospital staff for an officer to be detached for this purpose, and if he is detached, either he will complain of the double work, or the senior officer of the hospital will complain, and in the end the sick staff at the base will be unattended to.

There is a great mass of unorganised details of sorts always hanging about the base. The staff itself is very numerous, the clerks are very numerous, the correspondents, the contractors, the sutlers, the "travelling gentlemen," the transport employees, and

a crowd of others, all need to be provided with medical aid and medicines. For this purpose a medical officer is needed. He should be sent out from England for this work, and it should be a special appointment. He pitches his tent in the base commandant's camp. He puts up a sign-board. He fixes an hour when he can be seen in the forenoon and in the afternoon. He is the adviser of the whole of the people before mentioned, and if they be slightly sick he attends them in their tents. If it be merely an illness for the day he detains them in their own tent; if they be seriously ill he arranges for their removal to the base hospital. He has a compounder from the Medical Staff Corps who is ever ready with medicines to treat any diarrhœa or sudden illness occurring round the camp. He has also an orderly who assists the sergeant. This officer is quite essential. It is very unfair on the base staff not to give them a definite, unchanging medical adviser, and to allow them to run the chance of being seen by a doctor from the base hospital is very unfair. A medical officer is allowed to take medical care of the divisional staff, but the base staff is more numerous and more important than is the divisional staff. We require, then, a medical officer to be posted to the base as in medical charge of staff at the base.

SECTION V.—THE MEDICAL STORE DEPÔT AT THE BASE.

The supply of medicine to an army in the field is of great importance, and the means at our disposal for carrying out the work are worthy of study. We must, I think, look on the medical store staff at the base and the advanced store depôt in front as the germ of a medical store branch.

The regulations allow a surgeon-major as in charge of medical store depôt, and under him is a quartermaster who is the medical storekeeper. Probably *chief* medical storekeeper would be a suitable title for the surgeon-major whose position in reference to the quartermaster would be more defined, and the medical officer in charge of the advanced store depôt, who is now allowed, would also be a medical storekeeper under the chief storekeeper. Compounders, clerks and packers are allowed by the regulations for the subordinate store work. Here, again, the shipment of the unit from England could take place together, and the two medical officers and the quartermaster and the men could all go out together in the same vessel; the junior medical officer assisting his chief at the base until the army advanced.

If the campaign is to be with wheeled transport, there is no reason why the waggon or waggons that are to carry the advanced stores should not be packed on board with the stores, so as to be ready when landing in the enemy's country, needing only transport animals. Continental armies have a fuller medical store staff than we are allowed, and probably each division needs a medical store-keeper with his own waggon and transport keeping his division supplied.

The store dépôt should be on shore and not on a ship in the harbour. Delay is occasioned by such a system and messengers who cannot hire a boat have to lose time waiting on the shore. A red cross flag should be flown over the dépôt and a large sign-board put up to show people the way to it and the hours when it is open. It should be open almost always.

Several compounders seem to be needed at the base to make up pills and portable medicines for those in front with the army. We need to copy more and more the cartridge system of the army and to issue all field medicines in the smallest possible unit. Constant difficulty is experienced in getting bottles in the field, and probably all dry drugs should be in tinfoiled cardboard, or tin boxes of a very small size.

All fluid drugs should be packed in very tiny units, say from 2 to 4 ounces, but highly concentrated.

All loose quinine in bottles is, of course, much in the way. Every ounce should be compressed, packed in tinfoil in cardboard cases, enclosed in tin matchbox-like covers. This principle applies to all drugs. Great rolls of lint should be abolished and square compressed patches of certain definite sizes used. Probably all anti-septic dressings can be compressed very much in bulk.

The most untractable and unmanageable article of equipment we now retain is the ship medicine chest, supplied for stationary field hospitals. It is impossible to carry it in anything but a cart, and as carts cannot always travel, it is an encumbrance.

The panniers should supply enough drugs for all war purposes, save at the base of operations. But the medicine chest is an extraordinary heavy contrivance, and might be broken up into two panniers with advantage.

Great advantage would result from handing over the surgical haversacks at once to the bearer companies on mobilisation. They would be familiarised with them before the campaign began. Eight seem hardly sufficient for a company. One is needed for each medical officer, and one for each N.C.O. of the company, in addition

to the existing eight, so that sixteen is more like the real number needed.

If once the medical store dépôt worked well, the various field panniers of comforts and equipment might gradually be handed over to it, instead of being in the hands of the ordnance department.

The more the medical service does for itself the more likely is it to be efficient.

It seems a very great waste of energy that to obtain any supply, however small, from the store the counter-signature of the P.M.O. is needed. In war, all this countersigning should be diminished or abolished. Thefts of medicine are unlikely in war, and a certificate from the senior officer of a hospital that supplies are needed should be sufficient for the storekeeper, and, unless the demand be outrageous, he should meet it. To wait for the P.M.O.'s signature often entails long delay.

It would probably tend to efficiency if the chief medical storekeeper at the base was placed in direct communication with a director of medical stores in the medical department of the War Office at home, certainly in so far as filling up to a defined standard. Having to report through P.M.O.'s of the base and communications to the surgeon-general in the front is a long way round, and delay is entailed. If a trusted officer held this post, there seems to be no reason why he should not communicate with the chief medical authority on stores at the War Office.

I do not think that any of us in the rank and file of the medical corps have given sufficient study to this branch of medical service, nor have we, as in India, a body of medical storekeepers. Had we paid more attention to it, we should long since have developed a system of portable drugs, compressed, easily distributed and really fit for war. Until quite lately we went to war as if we had the Apothecaries' Hall next door to us.

Just as we have a sanitary head and a medical head of sub-departments in the Director-General's office, so probably a director of medical stores should be developed, and known as head of a sub-department, in the medical office at the War Office. On him would fall the responsibility for the preparation of stores for the field and for garrison, and by thus specialising him, doubtless progress would occur. He would free the Director-General from some of his existing heavy responsibility, while still remaining completely subordinate to him. He should be an officer with war experience and knowing war needs. Under him the chief medical storekeeper at the base, and the medical storekeeper at the advanced

depôt would serve, and without further counter-signatures, all reserve stores should be kept up to a defined standard.

As a means of familiarising us with our war medical material, probably a pair of mule panniers should be at all times with a regiment in peace, and from it all drugs for the treatment of ordinary sick be taken. We would thus be familiarised with our medicines available in war-time.

Gradually we might take over into our charge all special medical field equipments, such as stretchers, cacolets, and litters, and articles of hospital equipment. To-day centralisation is the curse of our army, and it is painful to see the intense overwork this centralisation causes in war-time to the ordnance store department. We should free them from as much of this as we could, by taking into our own custody in peace, as much of our special war equipment as we possibly could. To keep all our stores concentrated in Woolwich Arsenal is to leave us ignorant of their use in war, and to entail immense labour in drawing them out for mobilisation. Why do we not localise our stores at the headquarters of every district, and so free the central arsenal from the enormous strain every war entails on it? We need in the army three things: (1) *Decentralisation*; (2) *decentralisation*; (3) *decentralisation*.

SECTION VI.—THE BASE HOSPITAL.

One of the great developments made since the 1882 Egyptian campaign is the laying down of a definite base hospital for location at or near the base of operations.

We all know bitterly how much the medical corps as a body suffered from the tremendous strain placed on the Ismailia so-called base hospital—a hospital which was in truth simply a 200-bed, non-hospital-dieted field hospital doing duty *pro tem*.

To-day we are in an infinitely better position, for we have now given to us a defined base hospital for 500 beds.

The hospital care of 500 sick and wounded at the base hospital of an army in the field is the gravest, heaviest responsibility that can fall on any medical officer, and the officer who in our future wars successfully *runs* such a vast undertaking will stand forward as one of our best men; for not only will he have to deal with the 500 patients in hospital as in a great civil institution, but perpetually, day by day, nay, hour by hour, the sick population will be changing by the arrival of wounded from the front and the departure of sick and wounded to England and the hospital ships. It will be onerous in an enormous degree, and no reward will be too

great for the officer and the staff who make it a success. Five hundred sick in any hospital are a great mass to care for, even with all the resources of civilisation and years of defined working behind one as an aid, but to care for 500 gravely wounded soldiers or men broken down from typhoid or dysentery, hastily flung together on some savage shore, removed from all civilised outside aid, and with no long-continued tradition to aid in the work, is a truly herculean task.

There is a road to success and one only, in dealing with such an institution—it is summed up in one word, and that is *decentralisation*.

I maintain that to successfully work any base hospital of 500 beds the most absolute, the most complete, the most extreme decentralisation is needed. With decentralisation success may come; without it chaos is certain.

And first of all it is needful to define the responsibility of the staff of that great hospital. Their duty is, I take it, bounded entirely by the hospital enclosure and grounds. Beyond that boundary they have no responsibility. And the reason for this definiteness is that we want to fix all responsibility for the carriage of wounded to the hospital, and from it, on somebody else besides the hospital staff told off for nursing duties. I am aware, of course, that in the first few days of war, confusion of duties is liable to occur, and all must work for the good of the national forces; but I refer now to the weeks and months during which a campaign goes on, and through all of which the base hospital works at high pressure.

The duty, then, of sick convoys, either to or from the base hospital, is no part of the work of the base hospital staff. That duty falls upon the P.M.O. of the base, who can only provide for it by fatigue parties from the bearer company forming the Medical Staff Corps Dépôt at the base. The nursing orderlies cannot do this duty; if they do they cannot nurse the sick, and the sick will die, and the responsible officer of the hospital will have the power to plead the overwork of his men as an excuse for the breakdown of his hospital. No such ground of excuse should be left in his power; but the way to cut away all complaints is to provide otherwise for all outside duties.

Having thus limited the responsibility of the chief officer to the enclosure of his hospital, we have cleared the road for a definite fixation of responsibility.

Within the limits of his hospital he is entirely responsible, and

it is his duty to make the machine work. But he cannot do impossibilities, and he cannot succeed without the means of success. Success means men to do the work.

The book of the army system of organisation lies open for us to read if we care to do so. The method by which, say, a force of thirty guns of artillery is built up, is by first taking the six guns of a single battery and making them a working unit, and then taking five such batteries, each individually complete, and joining them together, and adding a chief commander and an adjutant to the already complete individual units.

To apply this system to our hospital organisation is to copy a successful system, and one which has stood the test of war. If we decide on massing 500 beds as a base hospital in war, the only sure way of building up a successful institution is by resolving it into decentralised completely self-contained units, and joining them together.

Measured by this standard the 500 bed base hospital resolves itself at once into two stationary field hospitals as now sanctioned, each containing 200 beds, and one field hospital for 100 beds, as now sanctioned. If we can develop officers who can accurately work 200-bed stationary hospitals, and 100-bed field hospitals, we have simply to add to these three units a centralising, co-ordinating and inspecting staff to make the whole machine work.

It may be stated at once that to work any central cooking system for 500 patients and the heavy staff (some 150 men) needed for their care is quite impossible. A centralised cooking place could never possibly work without utter confusion and impossibility of success. To keep 500 sick in one place may be needful in war, but to avoid the outbreak of disease amongst such an agglomeration of ailing men the units must be separated far apart and ample space intervening allowed. The very space paralyses all central cooking. But apart from that, if you do not make the chief doctors of divisions responsible for the cooking in their own divisions you will never have really good cooking. Each division needs its own special cooks, its own special cooking tent, or shed, and for its efficient working the divisional doctor is responsible, and it is to him the chief doctor of the whole hospital looks if any error or neglect is made in his division.

In the same way the 150 orderlies and Medical Staff Corps men need their own separate cook-house quite apart from the hospital divisional cook-houses, so as to diminish all chance of confusion by overcrowding. In the same way the washing of the clothes

and bedding of the sick needs decentralisation. The washing for 200 sick is in itself a large matter, but if we are to have it well done we must make each divisional group do its own, and blame the doctor in charge if it be badly done. The chief medical officer of the hospital is not a man to do work himself, rather is he there to see that others do it.

If we built up the base hospital on these lines it would at once increase the staff of medical officers of divisions by four, viz., from eighteen now laid down for the base hospital to twenty-two, which would be arrived at by the building-up principle. Of course, the P.M.O. of the hospital and his secretary should not count as workers in the ward. They are administrative staff quite surplus to the ward workers.

Four extra medical men would be given in addition to the existing detailed strength.

If we then examine the quartermasters allowed, we find that if we built up our unit we would have a quartermaster for each 200 beds, and one for the 100 beds in addition, and one would be needed as chief quartermaster, or a total of four quartermasters for the 500-bed base hospital. The work at a 500-bed hospital of this kind would be almost as heavy, and certainly more exhausting, than at Netley, and the risk of the one officer breaking down would be infinitely greater.

I do not think that the presence of warrant officers as laid down in the scale for the hospital, take away from the need for the quartermasters. Two of the three warrant officers are chief wardmasters, that is to say, nursing superintendents and not storekeepers, and the third warrant officer is steward or under storekeeper, so that they in no way share the quartermaster's responsibility. If quartermasters in ample sufficiency are not allowed for these great masses of sick, called base hospitals, it is certain that the medical officers will be called on to act as quartermasters, and will thereby be taken away from their more important skilled duty. It seems to me difficult to over-rate the heavy work needed of a quartermaster in a hospital. In a base hospital the work for one officer will be simply stupendous, and the financial responsibility and the enormous mass of accounts needed of him will be an intense labour. Of course, under the new rulings the P.M.O. of the hospital is financially responsible for all stores and equipment, but the executive charge still falls on the one quartermaster. So far as I have seen in the field, the work is too heavy for any one man to accomplish.

I take it that the building-up system of organisation would well come into force here, and that to each of the 200-bed sections a quartermaster would be allowed, one also being allowed to the extra 100-bed section, and one senior or chief quartermaster allotted to the whole to serve with the P.M.O. and the secretary, and to be a responsible head of the storekeeping department.

I would dread the loss of money and stores that would result if the one really responsible financial officer should fall sick.

Carrying out the same principle of building up a hospital by perfectly complete units joined together, we come to the subject of compounders. In a stationary hospital of 200 beds, probably two compounders are sufficient, and as the base hospital has 500 sick we would need in the same proportion at least five compounders, or one per 100 sick. One per 100 seems by no means overmuch, and this is allowed on the hospital ship where 200 sick are accommodated. The very custody of the medical stores for a hospital of 500 beds is not a little thing, and probably five compounders—that is, two for each 200 beds, and one for the 100 beds extra, are really needed. There must be a night compounder on duty in so large a hospital and where wounded arrive at all kinds of irregular hours, and the danger is that one of the compounders would fall sick from overwork. In this case, as in others, the building up of the unit by completely defined minor units is probably the true system.

The washing of the clothes of the sick and of the attendants in a large 500-bed base hospital is all important.

While we talk of antiseptic treatment of disease we must ever remember that the first great antiseptic agent in a hospital is the washing machine and the laundry staff. It is in vain to attempt antisepticism unless this be provided for.

The regulations allow two washermen per 100 sick in the field hospitals, and the same proportion in the stationary hospitals, viz., four for 200 sick.

On the building-up principle this would give ten washermen for a 500-bed hospital, and this is barely sufficient with machines and every other aid.

Nothing is more degrading than to have our sick men covered with lice as they were at Scutari. The only true lice-killer is the laundry boiler, and the constant change of bed and personal linen. The experiences of Ismailia in 1882 are completely to the point in this matter. The soiled clothes of the sick were sent on a regular wild goose chase from Ismailia to Cyprus and thence to Alexandria, and were finally washed by the marines there. What marines can

do our own hospital attendants can do, if regularly told off for the purpose. We need, then, at least ten washermen for the base hospital, and if we take these ten men away from the existing ten supernumeraries allowed to the base hospital it only allows two men to do all the water supply and all the conservancy, *the all-important, burning question of the conservancy* for the 500 sick men. Sir Edward Morris in his evidence before Lord Morley's Committee, distinctly throws the responsibility for the washing on our own hands, and all questions on this subject are at rest by this declaration.

One has little or no faith in contractors supposed to be found for us in war-time. If we take out washermen with us the clothes will be washed. If we do not take them out the clothes will not be washed. This is, after all, the final result.

We have said that if we take away ten washermen from the supernumeraries now allowed to the base hospital we have only two men left for all water supply and conservancy work. On the building-up principle we should have twenty-five men allowed us for this purpose, that is to say, five men per 100 sick are allowed in the field hospitals, and as the base hospital is for 500 sick, five times as many at least are needed.

We would require thus at least twenty-three men added to the base hospital staff for water supply and conservancy purposes. Nothing can be more terrible than defective conservancy arrangements near a hospital, and the only way to deal with the subject is by allowing men definitely for the purpose. To employ a nursing orderly, who is tending the wounds of the soldier, to be utilised in any way as a conservancy man would be a fatal step, but if a definite supply of men are not available, such a proceeding will be necessary.

One has the greatest dread of these subsidiary services being undermanned, because it is quite certain that if they be undermanned the nursing orderlies must needs be fallen back upon for the performance of a work, fatal to their fitness for nursing duties.

SECTION VII.—HOSPITAL SHIPS AT THE BASE.

On this I have but a few words to say. We have now reached, I think, a high pitch of efficiency in this direction, and there is no reason why a hospital ship should not be a very perfect machine. One certainly seems disappointed at the small sick space the hospital ships really allow, and the engines and coal bunkers occupy much room in all these vessels.

Great advantage results from the hospital ship being connected with the shore by telephone. This idea was carried out at Suakim by Deputy-Surgeon-General Hinds' orders.

A brief code of signals by flags between the ship and the shore is very useful. This also I learned at Suakim. Two or three steam launches are needed for the hospital ship to tow the sick boats from the shore.

A special sick transport boat is needed to take off the sick and wounded from the shore to the ship. Such a boat is to be seen at Haslar Hospital working in Portsmouth Harbour. There is need of a boat to take patients out for airing in the harbour, and to get them free from the hospital ship for a time.

The companion ladders of the ship should be very wide and well balustraded to admit sick men being carried up in a carrying chair. A carrying chair is very useful on board ship to give invalids an airing. A pontoon stage might be used beside the ship on which the sick could be lifted before going on board.

A painted sign-board is needed on the pier showing the hours that steam launches run between the shore and the ship with sick, and the visiting days and hours on board the ship.

SECTION VIII.—THE "SICK TRANSPORT SHIPS" FOR ENGLAND.

Great advantage results from the special sick transport ships regularly fitted up as hospitals being utilised between the seat of war and England. It is really impossible to care for sick and wounded men in the ordinary transport vessel, and it seems unfair to take a man out of a highly organised hospital ship and send him to England in a transport vessel not specially fitted as a hospital. The suffering entailed by the want of water-closet accommodation alone is excessive.

But where the evil is very marked is in getting together a scratch team of doctors and medical corps for these scratch sick transport ships. If no definite ship is fitted out from England, when wounded leave to go home the P.M.O. must gather together any doctors he can lay hands on, and thereby must weaken the definitely equipped field units. If no medical corps men are specially provided in England for nurses we must draw men from some unit where they can ill be spared, and where, through want of men, the sick will be uncared for. In every war, then, the specially fitted and manned sick transport ships are needed as well for the well-being of the sick as to prevent the doctors and staff originally detailed for the field being utilised for the return journey. It

should always be remembered that a ship specially built for a hospital ship can always be utilised as an ordinary military transport, but the reverse is not the case.

There will always be a dangerous gap in our line of communications until the sick transport vessels are as sure to be found present as is the base hospital. Two, at least, are needed to be perpetually going back and forward during the campaign between England and the base.

SECTION IX.—THE MEDICAL STAFF CORPS DEPÔT AT THE BASE.

We have dealt with this subject very fully in the paragraphs about a transport medical officer at the base. The medical corps of an army corps in the field must be looked upon as a regiment whose headquarters is at the base and whose companies in the shape of field hospitals and bearer companies are scattered along the communications and on the fighting front. But if it be a regiment it needs a definite depôt at the base, with a commanding officer, an adjutant, a quartermaster and a paymaster.

I propose that the bearer company at the base fulfils these two functions, viz., that of depôt and transport company. A bearer company has three medical officers and one quartermaster and some fifty-seven men. The senior officer to be transport officer and to command the depôt. The second senior officer to be adjutant, the third officer to assist in the transport work. The quartermaster to keep the clothing and equipment documents of the whole corps, and a paymaster of the Army Pay Department to be attached as corps paymaster.

This will free the base P.M.O. from all responsibility, and the documents now sent to the registrar of the base hospital will be kept together in the hands of the adjutant. A certain number of the men of the company to be given to the sanitary officer for his police duty, fatigue parties for the medical store depôt to be supplied, and from the depôt company any casualties in the hospitals in the front to be filled up and all small parties arriving in the country to be attached for duty.

All medical officers landing in the country to find here the needful shelter for the first day or two.

The letters for the officers and men of the medical corps to be taken care of and forwarded by this company, who would tell off a trustworthy N.C.O. as postmaster for the M.S.C.

This depôt seems to me to be absolutely needed, and without the transport company at the base I do not see how the transport

work is to be done. Many officers to whom I have mentioned this idea consider it would be a great advantage.

SECTION X.—RESERVE HOSPITALS PARKED AT THE BASE.

Whenever the army lands in an enemy's country the reserve hospitals needed for the army corps should be landed and their *personnel* and *matériel* kept together in camp at the base. If this is not done and their *personnel* is utilised for other purposes, a day of reckoning is sure to come.

We must learn to see hospitals standing ready and idle, waiting to be employed, just as we see batteries of artillery standing idle waiting for use. Up to the present day we have so rarely seen medical units waiting ready to be employed, that we look upon it as quite wrong when we do see them, while we see a whole army quietly at rest waiting for the day of battle, that comes for a few hours once in every ten years.

At once when a field hospital and its *personnel* and *matériel* arrive at the base, they should be disembarked and pitched in some suitable place and equipped with their transport and special local field equipment. Officers and men should be practised at the pitching and striking of their camp, and every box and package examined and made ready for instant marching. Allowing the equipment to lie in the ordnance dépôt, unsorted and unchecked, or allowing the *personnel* to be drafted hither and thither, is certain in war to lead to confusion.

When once the hospital has been found complete and its commanding officer reports it as ready, then various duties may be assigned to its officers and men, always providing that they return to their camp at night and remain under the discipline of their own officers. Nothing so delights bad, idle orderlies as to be moved from under their officers frequently. The good and the bad are then confused together and discipline is powerless for good. Besides, it must always be remembered that if the officers and men are moved about the responsible commanding officer may any day allege it as a course of failure in the after working of the hospital. This complaining must always be borne in mind in every official organisation.

SECTION XI.—THE STATISTICAL OFFICER TO THE ARMY CORPS.

A most valuable step was taken in the recent Suakim expedition in attaching a special statistical medical officer to the force, for the purpose of assisting the P.M.O. of the troops in the field by compiling the sick returns of the army. It is, of course, a moot

question where such an officer, with his clerks and office establishment, should be located. He is without doubt the staff officer of the P.M.O. of the entire force, and in theory is one of his official assistants and should be with him in the field in camp. But in the recent expedition the officer was located at the base, and doubtless this precedent will govern future action.

At the base, commodious office accommodation is obtainable, and this is not possible at a camp in the front, and bulky returns cannot be easily carried with the marching force.

At the base all is possible and statistics can be accurately kept. Nothing could be more painful than the former system of work, when a P.M.O. without any secretary and overburdened with executive functions had, in addition, to compile the statistics of the force for the English home authorities.

This trouble will now pass away from the P.M.O., and a distinct statistical specialist will be found in all armies in the field. The statistical function of the P.M.O. in front should be merely to compile a general statement, not classified in any detail, of the number of men sick in the hospitals of the army. This is a very simple matter, but the compilation of accurate medical statistics, dealing with each individual illness or wound, is a laborious task and needs time and special office accommodation.

Doubtless the statistical officer at the base should be bound to submit to the P.M.O. of the force immediate information of any excessive existence of special disease, and should also communicate freely with the sanitary officer of the army and of the base.

To facilitate returns of sickness, advantage would accrue from having very simple sick return forms for war, and reducing them to a minimum. All our returns, like all our drugs, were until recently based on the customs of peace hospitals, where paper and time are of no importance. For war the most portable forms, simple as A B C, are needed, and in this respect we have much to learn. The Swiss medical service have a pocket book for medical officers which contains in a singularly portable form the various returns needed in the field. We need to copy this system in many ways.

We are gradually changing from an elaborate peace system to a really workable war system of work.

CONCLUSION.

In the preceding pages I have dealt with the various points which seem to need examination in the medical working of the base of operations. There are, no doubt, many other heads in the

same subject which have escaped my attention, and which those who have fuller experience will at once detect. It is absolutely essential that we should all contribute to the building up of the war efficiency of our own branch of the service for the sake of the nation. I do not know where to-day to turn to find a record of what the doctors needed at Scutari, or why in the past the medical side of campaigns have been such infinite labour to the officers concerned.

Military history has up to to-day been a history of the battle only. We need very much a history of the means by which the army was placed in position for the fight and how the wounded and the sick were cared for. The daily increasing value of the individual soldier as he rises to the status of a citizen renders it essential that every effort be made for his proper care in the field if wounded, and we must study calmly in peace what is needed for war. Thus only can success attend our efforts.

We are military specialists dealing with a special side of military work, but up to recent years the subject has not attracted much attention. As the soldier rises in the scale of citizenship, the means needed to care for him must also be developed. It is as a contribution to that development these paragraphs have been written.

Reviews.

YELLOW FEVER PROPHYLAXIS IN NEW ORLEANS, 1905 (Liverpool School of Tropical Medicine, Memoir XIX.). By Rubert Boyce, M.B., F.R.S. Published for the Committee of the Liverpool School of Tropical Medicine by Williams and Norgate, 14, Henrietta Street, Covent Garden, London. Price 5s. net.

In the Preface Professor Boyce writes : " In this short history of the yellow fever campaign in New Orleans in 1905, I have given an account of the measures which the inhabitants of that city adopted to stamp out the fever. I have made full use of the numerous documents with which I was freely furnished, and I reproduce very many of them with little comment of my own. The evidence shows in a very clear and simple manner how a large city of 330,000 inhabitants, suddenly realising that it was face to face with a serious outbreak, determined, without hesitation, to put into force the most recent prophylactic measures, to rigidly exclude all the older methods and theories, and to proceed at once to the complete extermination of the yellow fever mosquito. In adopting this plan of campaign there was never any hesitation or misgiving, the necessary funds were at once forthcoming, and all classes of the community heartily

joined with the medical authorities in the attack. From beginning to end it was a determined effort to rid the city of the *Stegomyia* pest, and to remove once for all the reproach from the Port of New Orleans that it harboured the mosquito, by means of which the disease alone could be propagated. The efforts were completely successful, and show what can be done by a community, without recourse to force, in a mixed population, and labouring under many other disadvantages.

"The example of New Orleans, as well as of that of the successful campaign at Havana in 1900, and of the great improvements which have been brought about at Vera Cruz, Rio and other places, should stimulate all nations in the yellow fever zone to undertake the extermination of the *Stegomyia fasciata*. Considering the comparative simplicity and inexpensiveness of the methods necessary to be employed, the only excuse for the presence of yellow fever in any district must now be attributed to indifference. The practicability of the systematic extermination of the *Stegomyia* will also, in my opinion, pave the way to a far more determined and scientific effort to get rid of the malaria-bearing *Anopheles*, towards which, unfortunately, a large section of mankind seem to have grown tolerant and apathetic, although it is now well known to be the greatest cause of the hindrance to progress in the Tropics. . . ."

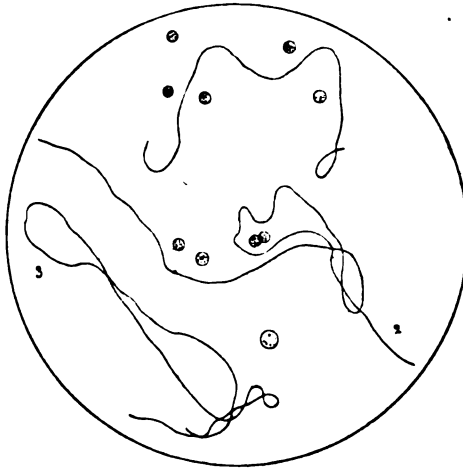
This memoir should be in the hands of every medical man who may be called upon to draw up a scheme for the prevention of malarial or yellow fever. In the case of New Orleans, the organisation was necessarily a large and complicated one, comprising some fifty medical men and over 1,200 inspectors and workmen. It also shows how absolutely necessary it is that a thorough scientific investigation should be made into the cause of a disease before practical measures can be expected to succeed. If it had not been for the research work of the Army Surgeons Reed, Carroll, Agramonte and Lazear in 1900, all this labour and expenditure at New Orleans would have been thrown away.

AIDS TO SURGICAL DIAGNOSIS. By H. W. Carson, F.R.C.S. London: Baillière, Tindall and Cox, 1906. 3s. 6d.

This little book is intended to assist students and practitioners in the diagnosis of the more common surgical diseases. It is of unequal merit, a mere list of symptoms being given in some instances, while in others the diagnosis is more fully gone into. The section dealing with tumours in the scrotum is less sketchy and more complete than most of the remainder of the volume. On the whole the book is good of its kind. But it is very doubtful whether books of this sort serve any useful purpose. They facilitate "cramming," and tend to make the student satisfied with a diagnosis that consists in putting a name to the case rather than a true appreciation of the meaning of the symptoms. The study of symptoms cannot be profitably separated from the study of the pathology of the conditions giving rise to the symptoms. Even for examination purposes, a book dealing with only one aspect of surgery cannot be recommended, while to the practitioner it can be of little or no use.

Current Literature.

Chyluria.—In a communication made at the International Congress of Medicine at Lisbon, April, 1906, by Professor Alberto d'Aguiar, under the title "*Sur une nouvelle forme d'évolution de la filaria sanguinis (Filaria bancrofti)?*" is given an account of some delicate filamentous threads found in chylous urine which, in the author's opinion, represent an unrecognised stage in the development of this organism. The patient contracted filariasis at Rio de Janeiro in 1896, as many as thirty-two filarial embryos having been found in one microscopic field at that time. Since then he had suffered from chronic intermittent chyluria, the attacks coming on every thirteen to fifteen months, and frequently, though not invariably, associated with severe renal colic. Since coming under Pro-



× 175.

fessor d'Aguiar's charge, in April, 1905, no filarial embryos have ever been detected in the blood by night or day, and examination of the urine during a severe attack of chyluria was also negative. At times, however, and especially in urine passed at night, long and delicate filaments were found in the chylous urine, freshly passed. These filaments varied in length from 0.3 to 1 mm. and were very thin, their diameter being approximately 1 micron. They were easily stained by aniline dyes, showed no signs of segmentation or granulation, and were unbranched and immobile. Professor d'Aguiar considers them as altogether different to bacterial filaments, and not to be confused with such things as elastic or connective tissue filaments, or with threads of fibrin, and suggests that they may play a part in the pathogenesis of chronic filariasis, and that they may represent either involution forms of filariæ or a developmental stage occurring in the human host without the intervention of the mosquito.

W. B. LEISHMAN.

Chavernac's Cycle-Stretcher for the Removal of the Seriously Wounded.—Surgeon-Major Bonnette, in *Le Caducée* for May 15th, gives a description of the new divided stretcher devised by Dr. Chavernac, of Aix-en-Provence, for the ready transport of the wounded, whilst at the same time obviating the serious inconveniences and the deplorable results to which these patients are often exposed by being forcibly or carelessly lifted.

The stretcher is a simple and yet handy contrivance, and is, furthermore, fitted with a small carriage on two wheels with ball-bearing axles and india-rubber tyres.

The stretcher is stated to be thoroughly rigid, and is divisible lengthways into two equal and symmetrical parts which are locked together by a simple contrivance [which, unfortunately, is not described.—J. E. N.]. It is designed with a view to simplify the method of lifting or lowering a wounded patient, and by its means a patient can be raised from the ground, removed to a distance, and then deposited on a bed or operating table, without having to be lifted by hand, as is the case at present.

The stretcher is loaded in the following manner: It is first divided into its two halves, the patient is then gently turned slightly on to one side whilst the half-stretcher is slipped under him; this manœuvre is then repeated on the other side, and the two halves are then locked together. The loaded stretcher is then placed on its carriage and then wheeled away; or, if the roads permit, it can be hooked on to a motor-tricycle for quicker removal if the case be an urgent one. To unload is even more simple; the stretcher is placed on the bed and then unfastened, when each half is removed separately without disturbing the patient.

The stretcher weighs 9 kilos., and its carriage 12 kilos.; it is thus lighter than the French regulation stretcher; it can be washed, passed through the flames, readily disinfected and rendered *aseptic*, and thus becomes an ideal *surgical* stretcher. [The material of which the stretcher is made is, unfortunately, not named, but it would appear to be entirely of metal, both framework and sheeting.—J. E. N.] The carriage is also fitted with a supply of metal sheeting, and straps, for splints when required for a case of fracture.

Dr. Chavernac's divided stretcher would appear to possess many advantages, and is certainly worthy of a fair trial by army-surgeons, as it can, apparently, be worked by fewer bearers, is not too heavy, is capable of being readily cleaned and disinfected when soiled by blood, discharges, or excreta, &c., and can be quickly dried when washed.

J. E. NICHOLSON.

The Hand-Grenades of the Japanese Army.—In *Le Caducée* for May 15th, Surgeon-Major Matignon describes the hand-grenades used by the Japanese during the late war. These grenades were first used at the Siege of Port Arthur, and were then merely little bags of cloth filled with Shimose powder; this method was improved upon by the Russians, who filled old jam-pots with this same kind of explosive which they obtained from the Japanese torpedoes which they fished up from the harbour of Port Arthur. After the siege, grenades were used during the remainder of the campaign. At the battle of Mukden, more perfected models—one might almost say of precision—were used on both sides.

The Japanese grenade consists of two main parts; the body, containing

the explosive, and the handle, which is joined to the former by a socket. The body is a tin cylinder, $4\frac{1}{2}$ cm. in diameter and 6 cm. in length, filled with Shimose powder, and containing a percussion fuse; it is surmounted with a tin cap which, when driven in, causes the grenade to explode. The grenade must always fall on its lower end, and this result is obtained partly by means of a leaden ring, 3 cm. wide and $1\frac{1}{2}$ cm. thick, which is fixed on to the case, thus giving weight to the missile, and partly by the handle which not only enables the grenade to be thrown with considerable force but also acts as a rudder.

After the battle of Mukden, in order to still further ensure of the grenade falling normally, a sort of kite-tail made of cloth, about two feet in length and one inch in width, was added to the end of the handle. This piece of cloth was rolled up round a short iron rod about one and a quarter inch in length and about as thick as a goose-quill, and this small rolled bandage was then tied to the handle. On the line of march the grenade is suspended from the waistbelt by the hook at the top of the handle.

When the grenade had to be used, the ligature securing the small linen roll was first broken. The missile was now seized by the end of the handle and hurled to a distance of at least forty or fifty yards. During its flight, the coil, being weighted by the small piece of iron, became unrolled, and, when the grenade began to drop, this tail acted as a guide, ensuring a perpendicular fall. Owing to this arrangement there were no more cases of "misfire."

Although largely used by infantry these grenades also proved useful in cavalry skirmishes, as even when the enemy aimed at was missed, the explosion often broke some horses' legs, and thus brought down both horses and riders. The idea is a novel one, but it possibly has a future full of promise before it. The order to "unhook grenades" may possibly not offer so fine a military spectacle as that of "draw swords" but the order to "hurl grenades" will, doubtless, show a better result in the shape of a butcher's bill than half-a-dozen mere cavalry "charges"!

J. E. NICHOLSON.

Correspondence.

TRYPANOSOMIASIS IN SIERRA LEONE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—The interesting paper by Captains Grattan and Cochrane in the May number of the Journal brings to mind a few notes on the same subject, showing, among other things, how important it is that we should not lightly disregard native medical knowledge.

Eight years ago, while serving in the Sherbro and Mendi country of Sierra Leone, I noticed many people with scarred necks, and on enquiry I was informed that the glands had been cut out by native doctors to prevent or cure sleeping sickness. My informants averred that sleeping

sickness had at one time not been uncommon in the neighbourhood, but that after the people found that the removal of the "nuts" or "banga" was efficacious, the disease had become rare. Whether the removal of the glands in the earlier stages of the malady could be of service in treatment we cannot say; but scientific medicine has now confirmed the native opinion that enlargement of the glands is an early symptom.¹ I offered 2s. a head for the names and whereabouts of sleeping sickness cases, but was unable to meet with one. In 1901, however, I found a case when I was taking the out-patients at the Princess Christian Hospital. The man was a Creole-negro who had been to the Congo two years previously. About this time Captain C. H. Carr, R.A.M.C., sent down from the "bush" a private of the West African Regiment, whom he had invalided for sleeping sickness, but the diagnosis was changed at the Headquarter Hospital. Subsequently I saw two or three cases of sleeping sickness in the Colony, but all had a history of having been to Fernando Po, Congo, or elsewhere down the Coast. The last case I saw was under Dr. W. Renner in the Colonial Hospital in 1904, and from this I successfully inoculated the common "mango monkey" and a rat with blood which had been for two hours or so in diluting fluid. Cases must have been coming from the Congo for some years, yet, though the Colony and Hinterland swarm with tsetse-flies, no local cases had come to light until Captain Forrest's discovery of one; and a very important discovery it is.

We may hope that the Colonial Government will set to work to stamp out the disease before it has spread beyond control, as it seems to have done in other parts of Africa. It is doubtful if any considerable portion of the Colony or Protectorate of Sierra Leone is free from *Glossina palpalis*. At Mabanta, where Captain Forrest's case first came to notice, I had no sooner mentioned my desire for tsetse-flies, at a penny each, to a small boy, than he ran off to the water-side, and he brought back half-a-dozen tsetse-flies in a few minutes. There are tsetse-flies all around Freetown. During a journey lasting some three weeks to the east and north of that port I found the people everywhere familiar with this voracious insect.

I am, Sir, yours truly,

Cambridge Barracks,
Portsmouth,
May 5th, 1906.

F. SMITH,
Major, R.A.M.C.

¹ It is usual to regard the glands as a beneficent organ acting as a filter for stopping objectionable substances and germs, but if we look upon it as also a place in which organisms can flourish in safety, and discharge poisons into the system of their host while they are preparing for a further advance, we may conceive that early removal of glands has claims upon our consideration. Prompt removal of non-suppurating glands might, indeed, prove to be of value in other diseases—syphilis for instance.

CORRECTION.

On page 50, vol. vii., July Number, line 8, for the word "largely" read "rarely."

Journal
of the
Royal Army Medical Corps.

Original Communications.

A NOTE ON THE BACTERIOLOGY OF A SERIES OF
CASES OF SORE THROAT.¹

BY MAJOR J. G. McNAUGHT.

Royal Army Medical Corps.

LIEUTENANT-COLONEL CALDWELL, in the chapter on "Barrack Room Sore Throat," in his recently published "Military Hygiene," draws attention to outbreaks of sore throat in barracks, and raises the question as to how far these cases are due to the *Bacillus diphtheriæ*, or diphtheroid organisms. During my service I have several times had my attention drawn to similar cases, and have speculated as to the relation of these cases to diphtheria. During the past year I have had opportunities of making bacteriological examinations of material from a number of such cases, and after reading Colonel Caldwell's remarks, I thought that possibly a short summary of the results might be of interest. The cases are too few to warrant dogmatic conclusions, but as there does not seem to be much information available as to the exact nature of the infective agent in outbreaks of the kind, it is perhaps worth while putting on record the results obtained where a series of cases has been submitted to bacteriological investigation.

The series of cases which form the chief subject of this paper occurred among the 17th Lancers at Piershill Barracks, during the

¹ From the Laboratory, Royal College of Physicians, Edinburgh.

winter and spring of 1904-1905. For the clinical notes and for the forwarding of material I am indebted to Captain A. J. MacDougall, R.A.M.C. The cases among the men occurred in two barrack rooms in which the flooring was worn and defective, and the special liability to sore throat of the men in these rooms was attributed to the use of too much water in scrubbing out and to the opportunity afforded by the defective floors for the lodgment of infectious dirt. Whether the state of the floors had any causal relation to the sore throats or not, it is the case that after the rooms were re-floored there was no prevalence of sore throat. The barracks are old and defective; the barracks rooms are situated over the stables, and are not cut off from them by any impermeable flooring.

In addition to the cases which occurred in this epidemic, grouped as Table I., I have noted the bacteriological findings in a number of other cases of sore throat, material from which was sent to me for examination. The reason which caused swabs to be forwarded was, both in the cases shown in Table I. and in the others, to ascertain if the illness was diphtheria or not.

There is still considerable difference of opinion among bacteriologists as to the relationship of a typical diphtheroid bacillus and of Hoffmann's bacillus to diphtheria. Some are inclined to think that Hoffmann's bacillus is sometimes capable of causing diphtheria. Graham Smith's researches in connection with an epidemic of diphtheria at Cambridge (*Journal of Hygiene*, vols. i.-iv., various papers), afford very strong reasons for considering Hoffmann's bacillus to be entirely distinct from the *B. diphtheriæ* and to be devoid of pathological importance. He found Hoffmann's bacillus present in a large percentage of healthy individuals, who had not been in contact with cases of diphtheria, while the Klebs-Löffler bacillus was found very rarely under similar conditions. He found Hoffmann's bacillus to be entirely devoid of virulence for the guinea-pig. The researches recently carried out on a very large scale under the superintendence of the Massachusetts Boards of Health (*Journal Massachusetts Ass. Boards of Health*, July, 1902), point to the same conclusions, though *B. diphtheriæ* was found present in a higher proportion of throats of healthy people than in the Cambridge cases. Nearly all the bacteriologists concerned found *B. hoffmannii* to be devoid of virulence, though one observer stated that in several cases he found the bacillus to be virulent.

The method followed in making the bacteriological examinations of material from the cases about to be described was as follows:—(a) A culture on blood serum was made from the swab

submitted. (b) Films were then made direct from the swab and stained by Gram's method, by Löffler's blue, and by Neisser's method, and examined. (c) Films were made from the culture on blood serum after eighteen to twenty-four hours' incubation at 37° C. In making the films, the specimen was taken from a mixture of a number of the colonies present on the blood serum. The films were stained as in (b). (d) In doubtful or special cases, the virulence of the blood serum culture was tested on guinea-pigs. In reporting results, I did not consider the presence of Hoffmann's bacillus to indicate diphtheria. The diagnosis of diphtheria was based on the presence of bacilli, staining by Gram, showing the usual appearances and arrangement of *B. diphtheriæ*, showing irregular segmentation when stained by Löffler's blue, and typical blue granules when stained by Neisser's method. Gram's method shows the clubbing of the ends of the bacilli very plainly when it is present. For practical diagnosis, one must rely on the microscopical appearances of the films made from the blood serum cultures after eighteen to twenty-four hours' incubation. The test for virulence is useful for confirmation, especially in cases where the clinical symptoms may be so slight as to cause scepticism as to the bacteriological diagnosis being correct. It involves a delay of at least forty-eight hours, and hence is not practicable as a routine measure. The question of the time involved also puts the investigation of acid production in glucose broth out of court as a routine measure. If this method is to be of any value, an absolutely pure culture of the bacillus present must first be secured; it is not easy to get a pure culture from the blood serum culture, as very often streptococci are present. The streptococci will crowd out the *B. diphtheriæ* or Hoffmann's bacillus in glucose broth, and as they produce acid their admixture would lead to mistakes being made. To obtain a pure culture of the bacillus present, plate sub-cultures must be made from the blood serum culture, and colonies examined before culturing in glucose broth.

The following tables show the number of cases examined, their clinical features (in those cases in which this information was furnished), the nature of the organisms present, and in a few cases, the results of tests for virulence.

Remarks.

With reference to the Piershill cases, it will be noticed that *B. diphtheriæ* was only found in one instance (No. 13). Clinically this was a mild case of sore throat. The *B. diphtheriæ* obtained

TABLE I.
CASES OCCURRING EPIDEMICALLY IN PIERSHILL BARRACKS.

No.	Name	Clinical Symptoms	Bacteriological Results	Virulence Tests
1	Pte. D., 17th Lancers	Sore throat ..	Staphylococci and Hoffmann's bacillus.	Guinea-pig not affected; rabbit not affected.
2	Pte. Dx., 17th Lancers	„ ..	Staphylococci and Hoffmann's bacillus.	
3	S. S. B., 17th Lancers	„ ..	Staphylococci, streptococci and Vincent's bacillus.	
4	Boy N., 17th Lancers	„ ..	Streptococci.	
5	Pte. B., 17th Lancers	„ ..	Staphylococci and Vincent's bacillus.	
6	Pte. McD., 17th Lancers	„ ..	Staphylococci, Hoffmann's bacillus and Vincent's bacillus.	
7	S. M. L., 17th Lancers	„ ..	Staphylococci, Hoffmann's bacillus and Vincent's bacillus	
8	Pte. B., 17th Lancers	„ ..	Large sporing bacillus resembling <i>B. mesentericus</i> .	
9	Pte. I., 17th Lancers	Tonsils swollen and showing white patches; enlarged cervical glands; temperature 101° F.	Staphylococci.	Guinea-pig died in 48 hours.
10	Pte. C., 17th Lancers	Sore throat ..	Staphylococci.	
11	Pte. S., 17th Lancers	„ ..	„	
12	Pte. W., 17th Lancers	Left tonsil swollen and showing white patches; temperature 101° F.	Vincent's bacillus, spirilla, Hoffmann's bacillus.	
13	Pte. W.C., 17th Lancers	Slight sore throat; cream-coloured patches on tonsils; a week later relapse, with yellow patches on tonsils	1st swab: Spirilla, Vincent's bacillus, <i>B. diphtherie</i> ; 2nd swab: (week later), <i>B. diphtherie</i> .	
14	Boy P., 17th Lancers	Sore throat ..	Staphylococci and streptococci.	
15	Pte. McL., 17th Lancers	Sloughing; ulcers on tonsils; temperature 100·8° F.	Streptococci and Hoffmann's bacillus.	
16	Pte. Ch., 17th Lancers	Headache, malaise, ulcers on tonsils, enlarged cervical glands; temperature 100° F.	Streptococci and Hoffmann's bacillus.	
17	Mrs. W., 17th Lancers	Severe tonsillitis	Vincent's bacillus, spirilla, and staphylococci.	

TABLE II.
OTHER CASES AMONG ADULTS.

No.	Name	Clinical symptoms	Bacteriological results	Tests for virulence
18	Tpr. T., R.G.A. ..	Slight sore throat	Staphylococci, Hoffmann's bacillus and <i>B. diphtheriae</i>	Guinea-pig not affected.
19	Gnr. C., R.G.A. ..	Slight tonsillitis..	Staphylococci.	Guinea-pig not affected.
20	Pte. C., H.L.I. ..	Sore throat ..	Hoffmann's bacillus ..	
21	Lieut. S., R.G.A. ..	Severe follicular tonsillitis	<i>B. diphtheriae</i>	Guinea-pig only showed local induration.
22	N. C.	Sore throat (case of scarlet fever in same house)	Streptococci.	Yeast showed no virulence for either rabbit or guinea-pig.
23	Corpl. M.	Sore throat (case of scarlet fever in same house)	„	
24	Corpl. S.	Sore throat	Streptococci and staphylococci.	
25	X. .. ..	.. .. .	<i>B. diphtheriae</i> and staphylococci.
26	V. .. ..	.. .. .	Vincent's bacillus, Hoffmann's bacillus and staphylococci.
27	Mrs. S.	Sore throat with congested fauces and dirty white membrane	A streptococcus and a yeast	
28	Mrs. N.	Sore throat with membrane	Staphylococci and Hoffmann's bacillus.	
29	Pte. O. .. ..	.. .. .	Staphylococcus and Hoffmann's bacillus.
30	Corpl. M.	Sore throat ..	Staphylococci.	
31	Z. .. ..	.. .. .	Staphylococci and Hoffmann's bacillus.
32	Pte. S. .. ..	.. .. .	Staphylococci.
33	Mrs. S.	Sore throat, grey patch on right tonsil, enlarged cervical glands, malaise, temperature 101° F., pulse 120	Streptococci.	

proved virulent to a guinea-pig. Vincent's bacillus was found in seven of the seventeen Piershill cases; it was only found once in twenty-three cases examined from a number of other stations.

TABLE III.
CASES IN CHILDREN.

No.	Name	Clinical symptoms	Bacteriological results	Tests for virulence
34	Child H. . . .	Acute tonsillitis; white patches; enlarged cervical glands; temperature 101° F.	<i>B. diphtheriæ</i>	Guinea-pig died in 36 hours.
35	Child S. . . .	. . . . .	<i>B. diphtheriæ</i>	Guinea-pig died in 48 hours.
36	Child M. . . .	. . . . .	<i>B. diphtheriæ</i> and staphylococci	Guinea-pig died in 72 hours.
37	Child R. . . .	Slight tonsillitis..	Staphylococci.	Guinea-pig died in 36 hours.
38	Child M. . . .	Slight sore throat and white spots on tonsils	Staphylococci and <i>B. diphtheriæ</i>	
39	Child W. . . .	Sloughs on one tonsil and uvula; enlarged glands, fever	Hoffmann's bacillus and <i>Diplococcus catarrhalis</i> .	
40	Child B. . . .	Sore throat and fever	Streptococcus.	

In the second series of cases, organisms which morphologically and in staining reactions could not be distinguished from *B. diphtheriæ* were found twice, but in neither case had the organism any virulence for the guinea-pig. On the other hand, the *B. diphtheriæ* found in the cases of children proved virulent for guinea-pigs in every instance. Cases 22, 23 and 27, in which streptococci were found, had all been exposed to infection from cases of scarlet fever. Case 27 was of interest on account of a yeast being isolated from the throat, which in morphology and cultural characteristics appeared identical with the yeast found by Klein and Gordon in the Lincoln epidemic of sore throat (Supplement to Report of the Local Government Board for 1902-1903, p. 599). It had, however, no pathogenic effects when tested on rabbits and guinea-pigs. The following is a description of this yeast :—

Morphology.—An egg-shaped organism; some cells round, only a few elongated. Few show budding. Hyphæ seen in preparations from glucose media. Stains by Gram's method. Neisser's method of staining brings out chromatic granules and cell wall, well.

Gelatine Stab.—22° C. Grey growth; no lateral offshoots till after some days, at 22° C.; branching never well marked.

Glucose Agar Stab.—37° C. Profuse growth ; gas.

Glucose Broth.—37° C. Profuse growth ; grey flocculi united to form a network ; much gas.

Broth.—37° C. Slight growth ; substance clear ; powdery sediment.

Bile Salt Glucose Broth.—40° C. Profuse growth ; acid, gas, pellicle formation.

Milk.—37° C. Unchanged.

Blood Serum.—37° C. Thick porcelain white growth.

Agar Plate.—37° C. Dark grey colonies ; outline irregular ; irregular branching processes.

From Case 39 a growth of a non-Gram-staining Diplococcus was obtained. This organism was isolated and subcultured, and proved to be the *Diplococcus catarrhalis*, described by Ghon and Pfeiffer (*Zeitschrift für Klinische Medizin*, xliv., 1902, p. 262). It is of interest from its close resemblance to the Meningococcus, and from the consequent liability to confusion with that organism. It is somewhat larger than the Meningococcus, and it forms opaque colonies on agar. The following were the characters of this Diplococcus as isolated in this case :—

Morphology.—A Diplococcus, not staining by Gram. The cocci are kidney shaped, with concave sides facing each other, and separated by a short interval. Also found arranged in tetrads and in masses.

Gelatine Stab.—22° C. Growth very slight ; no liquefaction.

Agar Stroke.—37° C. Dull white profuse growth, resembling that of a Staphylococcus.

Agar Stab.—37° C. White growth ; surface expansion is thin and dry looking.

Broth.—37° C. Delicate pellicle, falling to bottom of tube readily on being disturbed ; powdery and flocculent deposit. No indol in the cold. Slight indol formation after twenty-four hours' incubation.

Milk.—37° C. Unchanged.

Bile Salt Broth.—37° C. Unchanged.

Potato.—37° C. Thin white veil-like growth.

Agar Plate.—37° C. Colonies dull white to naked eye. Under low power are rounded, with irregular edges, brown in colour, especially in the centre.

Lieutenant-Colonel Moffet, R.A.M.C., who forwarded the swab from this case, informs me that clinically it was very like a case of diphtheria ; antitoxin was given, and the patient's condition appeared to markedly improve in consequence.

THE GRIFFITH WATER STERILISER.

BY LIEUTENANT-COLONEL R. H. FIRTH.

Royal Army Medical Corps.

THE dominant rôle which water plays in the dissemination of disease on field service renders any means which secures purity of this alimentary essential a matter of the first importance to the soldier. Foremost among methods which claim to render water safe is boiling, or some subjection to heat. The sterilisation of water by ordinary boiling—that is, in open vessels—presents three main objections. These are: (1) it is extravagant in fuel; (2) the water is rendered flat and tasteless owing to loss of dissolved gases; (3) the treated water is hot, and some time must elapse before it is sufficiently cool to drink, except as tea or coffee. These difficulties have suggested to workers in this field of preventive medicine the need of subjecting the water to treatment by heat in something other than an open vessel, whereby there might result not only an economy in heat applied, but the obtaining of a water at once sterile, cool, and containing a sufficiency of dissolved gases. The pioneers in attempts to solve this question practically were the French, who some ten years ago submitted the Maiche and Vaillard-Desmaroux apparatus which we tested at Netley, only to find them unsuited, for reasons which one need not here discuss, to our wants. Following these machines came some designed by English makers and the well-known Forbes-Waterhouse apparatus, invented by the Americans and used by their troops in the Philippine campaign, and to some extent also by ourselves in the late war in South Africa and in Somaliland.

All these machines were designed on the principle of heat exchange, which, as applied to the purification of water, depends on the fact that, with a sufficient area of metallic surface of good conducting capacity and sufficient time, a given quantity of liquid will yield nearly all its heat to an equal amount of the same liquid. Thus a volume of water at 100° C. will give practically all its heat to an equal volume of water at 15° C., the hot water being cooled down to about 17° C., and the cold water heated to 97° C., less the loss by radiation. The recognition of this principle was, of course, a great advance towards the practical sterilisation of water under service conditions, the essential features for the success of an apparatus being (1) lightness and portability; (2) rapidity and

facility of operation ; (3) ability to deliver a considerable volume of water ; (4) ability to deliver a sterile but cool water. The earlier makes of machine failed chiefly in respect of (1), while some of the later types revealed the difficulty of reconciling (1) with (3) and (4). In fact, this is the real problem, how to get a machine at once portable and capable of yielding a considerable volume of cold water. Given portability, then, considerable volume of water is incompatible with cold water, and *vice-versâ*, or the delivery of much and cold water means a weighty and cumbrous apparatus. Curiously enough, feature (2) has never been a difficulty, most machines being capable of quick and ready working.

Matters were in a very unsatisfactory state up to 1904, when it seemed as if we had reached finality, as represented by the Forbes-Waterhouse and Lawrence apparatus. In the autumn of that year Dr. Griffith called on us in the Hygiene Laboratory of the College and discussed the lethal temperature for various disease-producing micro-organisms common in water. It so happened that we had been making some observations in respect of this matter just previously, and our results were in accord with Dr. Griffith's own results, which clearly showed that a very short contact at a temperature definitely short of boiling point was sufficient to kill all the ordinary pathogenic bacteria associated with water-borne disease. Our discussion led to that of practical means for the sterilisation of water by heat, especially for soldiers on field service, when Dr. Griffith told us that he had ideas for the making of a suitable apparatus, wherein the water was sterilised without submitting it to actual ebullition. We urged him to persevere and let the War Office have the opportunity of putting the steriliser to a practical test. In 1905 Dr. Griffith submitted his apparatus to us, and it was tested in the Hygiene Laboratory of the Royal Army Medical College with sufficiently satisfactory results to justify its being recommended for practical use by the War Office. The subsequent history is sufficiently simple, for, as the outcome of the inception of a School of Army Sanitation at Aldershot, where men of our own Corps are receiving instruction in the practical use of various apparatus and re-agents for the purification of water, we have been able to establish an experimental installation of four of the Griffith sterilisers at Whitehill near Bordon, by which 250 gallons of sterilised water can be delivered hourly for the use of the garrison of that camp. The installation is in the charge of and worked entirely by a corporal and eight men of our own Corps, who not only sterilise the water but pump it from the surface wells to

the tanks. As this constitutes an absolutely new departure in our campaign against preventable disease in the field, and may serve as a type or example how newer methods may be applied to the purification of water in a fixed camp on lines of communication, a short description of the steriliser itself and its compound installation cannot fail to be of interest to both officers and men.

The essential novelty in the Griffith water steriliser is the recognition of the fact that an exposure of fifteen seconds to a temperature of 72° C., or a momentary exposure of water to a temperature of 80° C., is sufficient to destroy all disease-producing micro-organisms that are conveyed commonly by water. The general appearance of the apparatus when fitted up is shown in fig. 1, from which it will be seen to consist of two main parts, namely, a boiler or heater on the right coupled to a recuperator or cooler constructed on the heat exchange principle placed to the left. Above the cooler is a small supply reservoir to which the water can be conveyed by hand or from a suitable tank or water-cart by means of the hosing, the flow of water through this duct being controlled by a screw tap and a ball valve. The heat is obtained from an oil lamp working on the pressure principle, placed beneath the heater within the door shown in the diagram; the various other parts are drawn in the same figure, and their general object will be understood from the following directions for the use of the apparatus. Place the heater and the cooler on a level piece of ground, about six inches apart, with the heater to the right. Connect the supply tank of cooler by means of the armoured tubing with the water-cart or tank. Connect the heater with the cooler by adjusting the rubber union H to the openings A and B, then turn on the water to the supply tank. When the heater is seen to be nearly full of water by inspection through the opening C, adjust the bent pipe G to the opening C and screw the gland home; place the lamp in position under the heater and light, or it may be lighted beforehand and then put in position, but it must never be put under the heater lighted unless the heater is full of water. Connect the expanded union I at E, taking care to have the expanded end around the aperture D in the heater; now connect the outlet pipe K with the opening F at the bottom of the cooler. As the water in the heater rises in temperature it will slowly pass through D, down the expanded union I to the cooler, but no delivery of water will take place from the outlet pipe K until the inner vessel of the cooler has filled with sterilised or safe water.

The vital part of the apparatus is the valve which controls the

passage of water from the heater to the cooler, and which cannot be seen in fig. 1 as it lies concealed within the heater. This valve is distinctly ingenious, and is so made that it expands or opens only when the water attains a temperature of 80°C. , closing automatically when this temperature is not maintained. The general

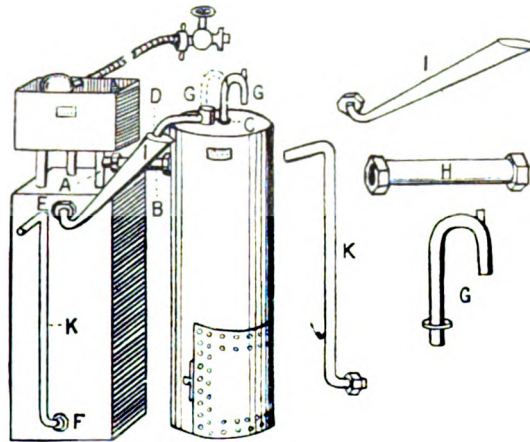


FIG. 1.

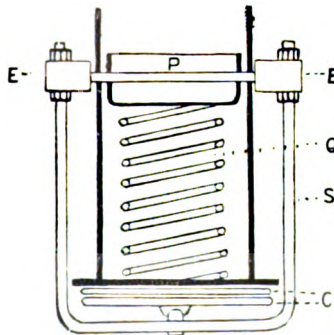


FIG. 2.

plan of this valve can be seen in fig. 2, in which C are certain capsules made of copper containing a mixture of alcohol and ether. When immersed in water having a temperature of 80°C. , these capsules expand or swell, and, being retained firmly by the stirrup S, against the bottom of the spring Q, force up the plug P, which

again lifts or opens a valve, not drawn in this diagram. This arrangement of expanding capsules is conveniently controlled or adjusted by manipulations of the screw nuts over and under the ends of the crossbar E, and once accurately adjusted require practically no further attention, beyond occasional inspection to see that the capsules are sound and in position. If the capsules or the spring require renewal they can be readily replaced from the spare parts supplied with the machine.

Continuous trial of this steriliser at the School of Army Sanitation, when worked by non-commissioned officers and men of our Corps undergoing instruction in practical sanitary duties, has demonstrated its efficiency and facility of application. The whole apparatus packs conveniently into two boxes, one containing the heater and lamp (full of oil) and weighing 80 lbs., the other containing the cooler and weighing 84 lbs. These can be unpacked, the steriliser put together, coupled up with a supply tank, lamp lighted and sterile water obtained, flowing from the outlet pipe, in fifteen minutes. This has been done over and over again by the men under instruction. The flow of water is wonderfully regular, the minimum delivery being never less than 60 gallons an hour; frequently it is at a rate of 68 gallons an hour; the rate of flow is dependent obviously on the amount of heat used and whether the lamp is burning well. This it generally does, even in a fresh breeze, but if oil needs renewing such an interruption for a few minutes reduces naturally the delivery in a given period of time. The temperature of the water at D, that is, when it leaves the heater, varies from 82° C. to 85° C. The temperature of the finished water at the outlet pipe is usually 9° C. higher than that of the original ingoing water when the delivery is kept at 60 gallons an hour; if the delivery is pushed, say, to 68 gallons an hour, the difference in the temperatures between the ingoing and outgoing waters may be as much as 15° C., but in all cases the water is sufficiently cool to be drunk at once. The capacity of the lamp for oil is 3½ pints if filled absolutely full; this is undesirable, as we find the optimum amount to be 3 pints. With care and an intelligent man in charge, this amount of oil will run the machine for two hours, but for practical or every day working, once filling of the lamp should be reckoned to run the steriliser for an hour and a half, or say, deliver 100 gallons of water. If oil is not available, the apparatus can be worked with wood as fuel placed in the position the lamp occupies in the heater. This is more troublesome to work than oil in the lamp, as frequent stoking is required. When

ordinary wood is used as fuel, a delivery of 40 gallons an hour is obtained, but if the wood be sprinkled with kerosene, 75 gallons have been delivered in the same time. Our experience has been that men learn readily how to work the steriliser and to manage the lamp; the only drawback to a general use of this class of apparatus is the necessity of not using a muddy water; if a muddy water is the sole source of supply, it should be strained before being passed into this steriliser. In future makes of this machine it is expected that this difficulty will be overcome and a means provided for clarifying a water before passage into the supply tank.

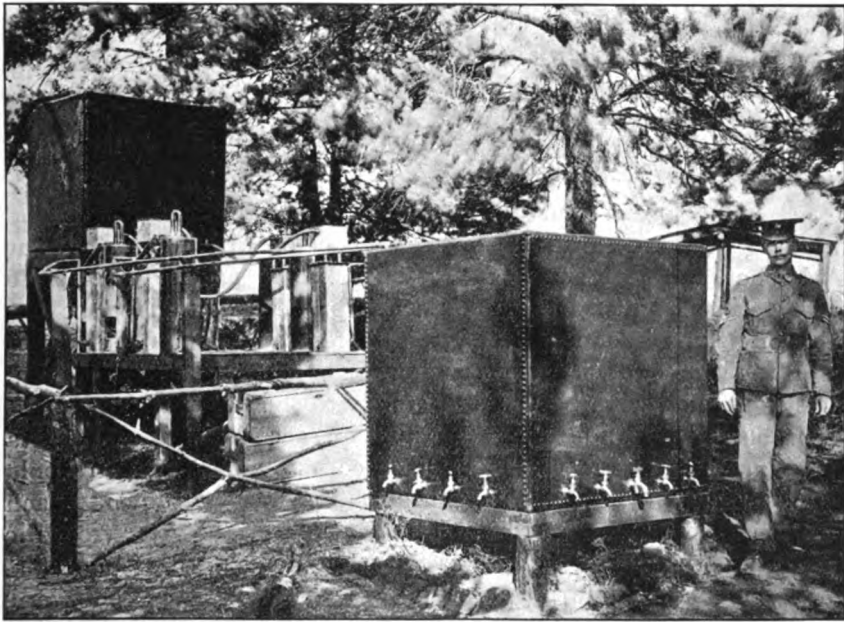


FIG. 3.

As illustrative of the practical application of this steriliser to the needs of a fixed camp, such as on lines of communication, where the water supply needs purification before issue, the installation of four of these Griffith apparatus at Whitehill near Bordon, is instructive. This camp having only a small garrison of some 600 men, served as a convenient experimental station. The outside daily need of safe water of this camp was put at 800 gallons. With four machines at work, 250 gallons of safe water can be supplied

readily per hour, or roughly, three hours' daily working of all four sterilisers is sufficient to supply the daily water requirements of the garrison. Fig. 3 gives an idea of the general arrangement made; it is not ideal, but local material only was employed, and no attempt made to supplement the installation by drawing upon outside resources. Two 400 gallon tanks in local use were fitted on to wooden supports or stands by the Royal Engineers. One tank was placed five feet and the other one foot from the ground. To the upper tank were fitted the four stop-cocks belonging to the four sterilisers, each of the taps being coupled up, by means of its armoured tubing, to a steriliser. The other, or lower, 400 gallon tank, was fitted with thirteen ordinary taps arranged around three of its sides, to serve as points from which safe water could be drawn after passage through the sterilisers. These machines were placed on a rough wooden platform immediately between the upper supply and the lower delivery tank, their respective outlet pipes being connected by ordinary piping to this lower or delivery tank. The whole installation is in charge of a corporal with eight men. These nine men belong to our own Corps, have been instructed in the working of these sterilisers in the School of Army Sanitation at Aldershot, and constitute a water squad for the provision of a safe and sterilised water to Whitehill Camp. In addition to having to work the actual sterilisers, this water squad pumps all water from the source of supply into the upper or supply tank; a corporal and eight men were allocated originally to this post, as it was felt desirable to run no risks of failure on account of too small a *personnel*, but experience shows that a corporal and four men would have sufficed. The following daily routine was laid down. Each evening the lower or delivery tank is filled with safe water from the sterilisers, this can be done in about an hour and three-quarters or a trifle less, while at the same time the upper or supply tank is filled by means of a lift and force pump. The two tanks are thus left full of water during the night, providing an ample supply for the early morning needs of the camp. As the lower or delivery tank is emptied it is refilled from the sterilisers working for about a couple of hours during the forenoon, and the supply tank replenished by pumping up from the source. By this means the two large tanks are filled twice each day. Of course on some days there is less demand for safe water than on others, if so, the sterilisers need working for a proportionately shorter time.

The average consumption of fuel at Whitehill, works out at about $2\frac{1}{2}$ pints of oil for each 100 gallons of water passed over.

This is better than was anticipated. The success of the installation at Bordon has justified its transfer to Welford Camp, near Lambourne, where it will be used in connection with the Cavalry Brigade training. Two other sterilisers are being tried singly, each being used in connection with an ordinary tank water cart at Oxney Camp.

So far this experimental installation has worked well. Of course there have been minor difficulties, but these have been overcome by the good sense, zeal and initiative of the corporal and men of our water squad in charge, and to them is due full credit for having made the installation a success. Further, not the least important lesson to be drawn from this experiment is that it shows how the problem of providing a safe and treated water for soldiers in camp is capable of solution by employing for this duty men specially trained in the use of the necessary technical apparatus; and that these men can be supplied from the Royal Army Medical Corps, whose function is clearly as much to prevent disease as it is to tend the sick. The due appreciation of this fact, and the proper and loyal co-operation of all ranks in furthering the evolution of the functions and aims of our Corps on these lines, is the pressing need of the hour. The intelligence and keenness for the work shown by the men who have gone through the school of instruction, shows that we have good material at our command for these duties. The solution of the problem how to supply a safe water to troops on the field, using for this purpose not only sterilisers of this type, but all and every apparatus or re-agent which science indicates to be suitable for our needs, is now merely a question of time, organisation and the provision of adequate equipment.

HEAT AS A MEANS OF PURIFYING WATER.

By DR. P. G. GRIFFITH.

WHILE engaged in elaborating a method for the rapid purification of water, I was struck by the advantage which would accrue if this could be effected at a temperature short of boiling by an exposure sufficiently brief to allow the process to be continuous. I therefore decided to make a series of experiments to settle the matter. I confined myself to those pathogenic organisms that are known to be water-borne, and as I only wished to ascertain the lowest temperature fatal to all, or, in other words, fatal to the most resistant of them, I did not attempt to determine that temperature exactly for those that are least resistant.

It may be well to give a brief recapitulation of the published results of other workers in this field. Unfortunately they were of little use in connection with my objective, since many of them were made for the purpose of showing that the organisms experimented on were non-sporing, and all were with one exception conducted either at temperatures too low to be rapidly effective, or on the other hand at 100° C. or over.

I can find no record of the thermal death point of *Bacillus dysenteriae shiga*.

Weisser gives that of *B. coli communis* as 60° C. with an exposure of ten minutes, and Sternberg confirms this.

The thermal death point of *B. typhosus abdominalis* is variously stated. I give a few from recognised authorities.

TIME OF EXPOSURE.						
60° C. ..	..	..	20 minutes	..	..	Pfuhl ¹
56° C. ..	..	..	10 "	..	..	Sternberg ²
60° C. ..	..	..	10 "	..	..	Abbott ³
55° C. ..	..	..	10 "	..	..	Janowski ⁴
60° C. ..	..	..	30 "	..	..	Muir and Ritchie ⁵

Janowski adds that if this temperature (55° C.) were continued for only five minutes, he could not rely on complete destruction of the organisms. Most authors agree that this bacillus is immediately destroyed by boiling, but in Muir and Ritchie's "Text-book of Bacteriology," it is stated that an exposure for two to three minutes at 100° C. is necessary for their destruction. It is difficult

¹ Clifford Allbutt's "System of Medicine," vol. i.

² Sternberg. "Text-book of Bacteriology," 1896, p. 51.

³ Abbott. "Principles of Bacteriology," 1902.

⁴ Janowski. *Centralb. für Bakt. u. Parasitenk.*, bd. viii., Nos. 6-9, 1890.

⁵ Muir and Ritchie. "Manual of Bacteriology," 1902, p. 309.

to conceive why it should require two minutes' boiling to kill non-sporing organisms, an important constituent of which (albumen) is coagulated by a temperature very far short of 100° C.

Sternberg¹ found that the *Vibrio cholerae* was destroyed by an exposure for four minutes to 52° C., but Kitasato was not always successful in destroying it by an exposure for ten or even fifteen minutes to a temperature of 55° C.

But the inquiry that most nearly approached the conditions I had laid down for mine was that of M'Fadyean and Hewlett² which was made to determine the effectiveness of an apparatus for purifying milk. This consisted essentially of four sets of coiled tubing forming a continuous passage for the milk, the first and third sets being immersed in boiling water and the second and fourth in cold water. Thermometers were placed in the milk current between the different sets of coils.

When milk was passed through the apparatus at a rate that allowed every particle of the liquid a period of thirty seconds to traverse the whole system, it was found that cultures of *B. tuberculosis*, *B. diphtheriae*, *B. typhosus*, added to the milk, were effectually killed. The temperature indicated by the thermometers in the connections between first and second and third and fourth sets of coils was 70° C. M'Fadyean and Hewlett ascribed the lethal effect of the process on the organisms mentioned to the alternate cooling as much as to the heating that took place.

I am inclined to think that the varying results of different observers depend to a great extent on errors in technique. It is by no means an easy matter to devise a plan for exposing organisms to a given temperature that is not open to some objection. For example, if, say, 10 cc. of culture are placed in a water bath of the required temperature, the culture must take some time to reach the same heat—probably a minute, and in cold weather even longer. Here is a possible source of error. The fact that one has to work with glass containers, which of course are among the poorest of heat conductors, makes an accurate time exposure more difficult than it otherwise would be. Sternberg's method is, I think, least open to objection. He exposed small quantities of culture in capillary tubes of minute diameter to the required temperature in a water bath. The tubes and a thermometer rested on a thick glass plate, and the water was kept constantly stirred to maintain an equal temperature. I was inclined at first to adopt this method,

¹ *Loc. cit.*

² *Journal of the Jenner Institute of Preventive Medicine*, 1902.

but I found that even these small containers retarded the passage of heat by three to five seconds. Eventually I devised the following simple plan. Two holes, sufficiently large to admit a couple of test tubes, were made in the lid of an ordinary double saucepan. The inner and outer saucepans being two-thirds filled with water, a sterile tube containing 10 cc. of broth was inserted into one of the holes in the lid, and into the other a second tube, containing 10 cc. of water and a thermometer. When the tubes were in position the saucepans were heated separately, and when the desired temperature was reached the inner saucepan was put in its place and the gas lowered to the merest glimmer. In this way it was possible to keep the temperature constant in the inner saucepan for about two minutes. A loopful of a culture of the organism experimented on was taken from a tube, held with a sterile tube in the left hand, the plug removed from the tube in the saucepan, and the loop of culture inserted in the hot liquid. After being exposed for the time determined on, the loop was withdrawn and an attempt at once made to inoculate the sterile tube held in readiness.

Certain possibilities have to be carefully guarded against. The platinum loop must not be inserted too deep if the culture is a liquid one, as the organisms adhering to the shank of the loop may not be inserted in the hot liquid. It is also of the utmost importance that neither the loop nor its handle should touch the sides of the hot liquid tube on insertion or withdrawal. If this should happen no further experiments should be conducted with the same tube.

By way of control a number of tubes were first inoculated with the various organisms, the method described above being followed exactly, the only difference being that the temperature of the saucepan and its contents was that of the room. In no single instances did the inoculated tube prove sterile.

Similar control experiments were frequently made in the course of the investigation, and invariably with the same result. This disposes of the possibility that the organisms might be washed off the loop while exposed to the heat. But to make quite certain that this did not occur, small portions of gelatine cultures were submitted to heat in the same way. If the scrap of culture was not visible after exposure, the experiment was not proceeded with. This, however, is hardly a fair test, since the gelatine may act as a protective covering to the organism, in the same way that the scum on heated milk does to tubercle bacilli.

The platinum loop was moved as little as possible while the organism was in the hot liquid tube. Culture tubes four inches in length and five-eighth inch diameter were found most convenient for use in the saucepan.

The time of exposure was either marked by an assistant or counted. After a little practice it is quite easy to count short periods of time with great accuracy.

Bacillus typhosus abdominalis (Eberth). — Cultures of this organism were at first submitted to temperatures of 90° C., 85° C., 80° C., for ten seconds, all with a fatal result. I had started with the impression that the fatal temperature would be somewhere about 90° C., and I paid dearly in loss of time for beginning with any preconception. Ultimately I found that an exposure of ten seconds was fatal at 66° C. to all the strains at my disposal. I had selected these with an eye to the duration of their existence *in vitro*. Amongst others, two were from strains that had been cultivated for at least six months, a third strain had been about a month *in vitro*, and a fourth a fortnight. The older strains were the most easily destroyed, an exposure for five seconds sometimes, and one of ten invariably, proving sufficient to destroy them at 65° C. The youngest strain was sometimes destroyed by an exposure for ten seconds to the same temperature, but not always. Cultures from the strain a month *in vitro* were killed by an exposure for ten seconds at 66° C. These results tend to show that the resisting power to heat of *B. typhosus* does not increase, as has been suggested, when that organism is grown in the laboratory.

Bacillus coli communis was killed by an exposure for ten seconds to 68° C. Its growth was retarded forty-eight hours by an exposure of the same duration at 66° C.

Vibrio cholerae and *Bacillus dysenteriae*. — Both of these organisms were destroyed by an exposure of ten seconds at 65° C. Probably both of them are killed by a temperature a trifle lower, but I did not pursue the enquiry in this direction.

I next endeavoured to determine what temperature was fatal when the exposure was as brief as could be contrived with accuracy of manipulation. Loopfuls of the different cultures were plunged in the hot liquid tube and removed at once. The manipulation had to be conducted with so much care that the actual time of exposure amounted to from two to three seconds. Allowing for the time the loopful of culture must take to reach the temperature of the surrounding liquid, it is probable that the real duration of

exposure was not much more than a second. I found that all were destroyed by an exposure of this duration at 72° C.

Up to this point I had worked with broth cultures, prepared generally from day to day, and as I have already remarked, these are after all the safest tests. But in order to be quite certain, I made a series of experiments with gelatine cultures, rejecting all where the scrap of gelatine was not visible on the loop after insertion in the hot liquid tube. The results were the same. But it may be well to note, for the benefit of any who may wish to repeat the experiments, that the addition of even a small quantity of gelatine culture causes a very faint cloudiness in broth which may easily be mistaken for commencing growth.

Finally, with a sterilised pipette, 5 cc. of a rich broth culture of *B. typhosus* were added to the hot liquid tube which contained 10 cc. of sterile broth at a temperature of 74° C. The temperature of the resulting mixture should be 72° C. A sterile tube was inoculated immediately with the mixture. No growth resulted. The same experiment repeated with the other organisms gave a negative result.

It is evident, therefore, that to render water absolutely safe for drinking purposes, as far as that liquid is concerned as a vehicle for the carriage of the organisms of typhoid fever, cholera and dysentery, and of *B. coli communis*, it is amply sufficient that it should be heated to a temperature of 72° C. for an exceedingly brief space of time.

I believe that in the future this fact may have a considerable influence in the prevention of water-borne disease. It is admitted that no practicable method of filtration as applied to public water supplies can be relied on, to prevent infection from water once contaminated. In heat we have an agent that may be used with certainty. Hitherto the cost of such application has been the obstacle. I shall endeavour to show that it need be so no longer. Kühn was the first to suggest this method of purifying water on a large scale. The apparatus he designed consists essentially of a boiler, the water supply to which is brought into intimate relation, without actual contact, with the outgoing boiling water, in a cooler or heat transferer in which the hot and cold water travel in opposite directions, so that the outgoing hot water is constantly brought into close proximity with water cooler than itself, while the ingoing water is as constantly approaching water of a higher temperature. With a steriliser of ten cubic metres' capacity he was able to treat 22,000 gallons of water per day of twelve hours, and double the quantity if the machine worked by night as well. Of this method

Rideal¹ remarks that "although on a small scale the cost of heating is high, it is obvious if the regenerating principle is successfully applied the fuel required is very small as the only essential of a perfect apparatus is that each unit of water shall be subjected to a high temperature for a short time, without permanently removing any of the heat required to produce that temperature."

It is, however, in attempting to secure this result that any process that necessitates boiling must inevitably fail. The latent heat of steam is much greater than that of water, and when steam is formed even in small quantities, the amount of heat expended is considerable, and is irrecoverable by any known method of heat exchange that is applicable here.² But if water is only heated to 72° C. it is perfectly practicable, even when working on a small scale, to recover all the heat expended, less 2.5° C. In the Forbes-Waterhouse³ apparatus for purifying water it is possible to reduce the temperature of the outgoing, to within 4° F. of the ingoing water. In this apparatus a certain proportion of steam is formed, the latent heat of which is completely lost by radiation. It is safe to say that if there were no steam produced there would be an even smaller difference in temperature between the ingoing and outgoing water. But taking this figure (4° F.) as a basis for an estimate of the cost on a large scale, though doubtless it would prove to be somewhat less, the expenditure in fuel would amount to 41½ lbs. of coal per head per annum, or with coal at 22s. a ton—something less than 5d. This does not appear a prohibitive price to pay for safe water.

The immediate practical value of the investigation is in its possible application in the supply of safe water to armies in the field. The expenditure of fuel for this purpose may be considerably reduced, and the purification may take place with more than twice the rapidity hitherto attained. With a trial apparatus built on the heat exchange principle and weighing 110 lbs., I have been able to purify water at a rate of more than a gallon a minute, the delivery of safe water commencing within four minutes from the application of heat.

I desire to express my obligations and thanks to Dr. Leslie Eastes and to Colonel Firth for many valuable suggestions in the course of the investigation, also to Dr. Charles Martin, Professor Hewlett and others, for supplying me with different strains of cultures.

¹ Rideal. "Water and its Purification."

² Babcock and Wilcox. "Steam: Its Generation and Use," 1903.

³ *British Medical Journal*, 1902, vol. i., p. 1104.

ENTERIC FEVER: IS IT INVARIABLY A WATER-BORNE DISEASE?

BY SURGEON-GENERAL RICHARD H. QUILL.

Army Medical Staff.

My attention has recently been drawn to a paper by Major Norman Faichnie, R.A.M.C., entitled "Enteric Fever: a Water-Borne Disease," which appeared in the May number of our Journal.

I have read with attention Major Faichnie's paper and note with regret that its arguments are based on the assumption that, given a good water supply, we may snap our fingers at any danger to be apprehended from the occurrence of enteric fever.

There is much in Major Faichnie's article which is tempting to criticism, but on this occasion I confine myself to replying to that portion of it which refers to a paper I wrote on "Air-borne Typhoid," in the Army Medical Department Report for 1900.

My paper contained an account of a very serious epidemic of enteric fever which occurred among the Boer prisoners of war incarcerated in Ceylon in 1900, and which, in a small degree, extended to the military guard which surrounded the Boer camp.

Sir Allan Perry, the Principal Civil Medical Officer in Ceylon, who was entirely responsible for the admirable medical arrangements made for the preservation of the prisoners' health, investigated, with the utmost care, the causation of the epidemic of enteric fever which commenced in the Boer camp on September 21st, 1900, and satisfied himself beyond all reasonable doubt that the fever, in the first instance, was imported from South Africa, subsequently spreading through the medium of the air, mainly, I should say, at the latrines, for at first it was almost impossible to induce the prisoners to report sick, and as a consequence, the latrines common to the camp became infected.

Sir Allan Perry further satisfied himself that connection of any kind between the water supply and the outbreak of fever might be confidently excluded, an opinion I also held, and which I consistently pressed when some weeks later the fever showed itself among the military guard, the safeguarding of whose health was my care.

Major Faichnie finds himself quite unable to agree with the conclusions arrived at by Sir Allan Perry and myself, so im-

pressed is he with the theory that *infected water, and that alone, is responsible for outbreaks of enteric fever.*

I will first deal with Major Faichnie's grave doubts as to the fever having been imported to Diyatalawa Camp from South Africa.

The transports bringing Boer prisoners of war to Ceylon arrived at Colombo in rapid succession, as will be evident from the following table :—

Arrival of Transport Date			Name of Transport	Number of Prisoners	Date of arriving in Diyatalawa Camp
August	8, 1900	..	Mohawk	243	August 9, 1900.
"	9, "	..	Orient	52	" 11, "
September	1, "	..	Ranee	598	September 3, "
"	5, "	..	Bavarian	1,290	" 8, "
"	8, "	..	Dilwara	988	" 10, "
"	9, "	..	Mongolian	724	" 12, "
"	22, "	..	City of Vienna ..	261	" 25, "
November	8, "	..	Ranee	241	November 9, "
January	9, 1901	..	Catalonia	631	January 10, 1901.
Total ..				5,028	

The first transport, the "Mohawk," brought no sick.

The second transport, the "Orient," brought practically no prisoners, its accommodation being taken up by the 2nd King's Royal Rifles, which, on arrival from South Africa, were to act as the military guard at Diyatalawa Camp.

The third transport, the "Ranee," introduced measles into the camp, a disease which rapidly spread in epidemic form, and did not cease until November 25th, by which date no less than 251 cases had occurred, with seven deaths.

It was not until the arrival of the fourth transport, the "Bavarian," on September 5th, that fever of the enteric type began to appear. There had been much sickness on board the "Bavarian" during her voyage from South Africa to Ceylon. On Colombo being reached, twenty-three cases of serious illness had to be transferred to the civil hospital at that port; of those cases nine were examples of enteric fever, all being of a severe type. From this infected transport, 1,290 prisoners reached Diyatalawa Camp, and among them, it cannot be doubted, were many who brought with them enteric infection. Ten days after this "Bavarian" batch reached the camp, one of them reported sick, and was found to be suffering from unmistakable enteric fever. On cross-examination the man acknowledged that he had felt very ill for ten or twelve days previously, but, hoping daily to feel better,

had neglected applying for medical aid. For those ten days the man had been using the camp latrine, as well as sleeping in infected clothes among a crowd of prisoners, and had thus freely spread infection. It is more than likely that there were many similar cases.

The fever being thus, as I maintain, introduced into the camp from an infected transport, the virus found highly receptive hosts among the depressed, debilitated prisoners of war, and a formidable epidemic of fever was soon started.

It appears to me that the chain of evidence connecting the epidemic of enteric fever at Diyatalawa Camp with South Africa is reasonably complete, but Major Faichnie refuses to admit such a contention. He is so enamoured with his "universal water infection theory" that he will admit no possible origin for enteric fever other than *impurity of the water supply*.

Was the water supply conveyed to the camps at Diyatalawa a pure or impure supply? That is the question I now propose discussing.

(1) The source of the water supply was what appeared to be a spring on the mountain side, some three and a half miles from the camp. This intake was extremely isolated and most difficult of access, as was brought home to me when, in company with Sir Allan Perry, I climbed the mountain side in the course of our search for a pure water supply. I can safely state that the source we selected was entirely removed from danger of pollution by wayfarers of any description, and as to the tea estates alluded to by Major Faichnie in his paper, the nearest was several miles distant. Between those estates and our spring was a dense jungle. So far as my recollection serves me I have fairly described the location of our water source.

(2) From the intake, which was surrounded with barbed wire, a large iron pipe conveyed the water to the two camps, *i.e.*, the larger one set apart for the prisoners of war and the smaller one for the military guard.

In the case of the prisoners' camp the water, on reaching it, was received into two large iron reservoirs, and from thence distributed by stand-pipes, conveniently disposed throughout the camp.

In the case of the military guard camp small iron pipes attached to the main conveyed the water directly into four large Pasteur tank filters, and from thence by stand-pipes in suitable positions throughout the camp. As a further precaution, Pasteur

or Berkefeld filters were placed in each barrack hut and subjected daily to careful examination. Thus all water in the military camp before distribution passed through a reliable filtering medium.

(3) The water in the large iron storage tanks located in the prisoners' camp was subjected to a weekly chemical examination, as well as to frequent bacteriological and microscopical examinations. The result invariably declared the water to be of *great purity*.

(4) No alteration of any kind was made in the water supply or filtering arrangements during the time the camp was in occupation (over two years); yet no case of enteric fever occurred among the troops, or I believe among the prisoners, subsequent to the cessation of the imported (?) epidemic in December, 1900.

I commend that fact to Major Faichnie, and would further remind him that the periodical rains continued in their due season, and that the tea estates remained under cultivation.

(5) No fresh milk except for hospital use was allowed within the camp precincts.

(6) All aerated waters were manufactured at Newera Eliya, the sanatorium of Ceylon, where no enteric fever existed.

(7) No native drinks of any kind were permitted.

(8) All soldiers leaving camp on duty or recreation were obliged to take with them a water bottle filled with filtered water, the use of which was impressed upon them.

The foregoing considerations and precautions in my judgment completely "put out of court" a water-borne origin for the epidemic of enteric fever which attacked, in the camp at Diyatalawa, the prisoners of war and their military guard, and justifies my emphatic denial of Major Faichnie's suggestion, viz., that the water supply was impure, and that such impurity was the real cause of the epidemic of enteric fever I have been considering.

No sanitarian denies the far-reaching importance of specifically infected water as an avenue for the introduction of enteric fever among a community; but I am glad to think that there are very few who are at one with Major Faichnie in believing that specifically infected water is the *only* factor which merits consideration when attempting to trace an outbreak of enteric fever.

SOUTH AFRICAN STOCK DISEASES.¹

BY COLONEL DAVID BRUCE, C.B., F.R.S., D.Sc.

*Royal Army Medical Corps ; President of the Physiological Section of the British Association, 1905.**(Continued from p. 153).*

B. PARASITE UNKNOWN.

III. DISEASES CAUSED BY PARASITES WHICH ARE PROBABLY ULTRA-MICROSCOPIC.

(1) *Rinderpest.*

We now turn our attention to the important diseases of the second group. In these the parasites causing them are unknown—that is to say, no parasites can be detected by the microscope or by culture—but it is equally true that they must be present in the blood and fluids of the sick animals in some form or other. In all probability they are ultra-microscopic—too small to be seen with our present instruments. This is borne out by the fact that they are able to pass through the pores of porcelain filters, which keep back the smallest micro-organisms we are able to recognise.

The first of the second group of diseases is rinderpest, which has overrun and devastated South Africa within the last ten years. Rinderpest has been known from time immemorial in Europe and Central Asia, and is an exceedingly fatal disease, killing 90 to 100 per cent. of the cattle attacked. The recent epidemic, according to some, originated in the Nile provinces, and slowly crept southwards, reaching the Transvaal in 1896, after a journey lasting some fifteen years. Great efforts were made to oppose its passage, but nothing seemed to avail. In parts of the country where there were few or no cattle the epidemic spread by means of the wild animals—particularly the buffalo—which have been exterminated in many places.

Ten years ago the symptoms and contagious nature of this disease were well known, but nothing was known as to methods of prevention, and it is to the investigation of this epidemic in South Africa that the discovery of practical methods of immunising cattle, and in this way of stamping out the disease, is due.

As soon as it was apparent that the epidemic was spreading into South Africa, all the Colonies made strenuous efforts to combat it. The Transvaal Government invoked the aid of the Pasteur

¹ Address delivered before the Physiological Section of the British Association for the Advancement of Science, at Johannesburg, August 29th, 1905.

Institute, and Messrs. Bordet and Danysz were sent out to discover some method of prevention. They worked near Pretoria, and were assisted by Dr. Theiler, then the Principal Veterinary Surgeon. Before they arrived on the scene the Natal Government had despatched Mr. Watkins-Pitchford, their Principal Veterinary Surgeon, to the Transvaal, where he also at first had Dr. Theiler as his colleague, and where he did good pioneer work in the serum therapeutics of the disease. In Cape Colony Dr. Hutchison, the Principal Veterinary Surgeon, and Dr. Edington, the Government Bacteriologist, were no less active. It is, however, to Professor Robert Koch, of Berlin, that the honour is undoubtedly due of first publishing a practical method of immunising cattle against rinderpest. He arrived at Kimberley on December 5th, 1896, and in the incredibly short space of time of two months was able to report two methods of immunising, viz., by the injection of rinderpest bile, and, secondly, by the injection of serum from immune animals. I have always thought that the discovery that the injection of bile taken from an animal dead of rinderpest rendered cattle immune, was particularly striking. Up to that time no one had dreamt that bile could possess such a quality. It is true that both Transvaal and Orange River Colony Boers are said to have used a mixture of bile and blood from dead animals before Koch's researches, and also that Semmer in 1893 showed that serum might be used for protective purposes; but still to Koch is due the credit of making these processes practical. After he left South Africa his work was continued by Kolle and Turner, who greatly improved the methods; and it is to them, and to the other workers mentioned above, that we owe the fact that rinderpest has now lost its terrors.

In the last recrudescence of this disease in the Transvaal, in 1904, Mr. Stewart Stockman, the Principal Veterinary Surgeon, and Dr. Theiler, thanks to the experience and knowledge gained during the last ten years, were enabled to stamp out the disease rapidly and completely. It is to them that we owe our knowledge of the dangers of the intensive method of inoculation, much used in the past and due to Kolle and Turner, and the introduction of the fighting against the plague by the inoculation of the healthy cattle by injections of immune serum alone.

In the tsetse-fly disease our advance in knowledge has been in regard to the causation of the disease, and not in its prevention; it is quite otherwise with rinderpest. The *contagium* or cause of rinderpest is absolutely unknown. We know it exists in the blood,

nasal mucus and other secretions of the sick animal, as all these are infective, but no one has seen it. The smallest quantity of blood will give the disease if injected under the skin of a healthy animal. We also know that the *contagium* is not very resistant. Blood soon loses its virulence after it leaves the body, and the effect of drying or the addition of chemical preservatives, such as glycerine, act also injuriously to the *contagium*, whatever it may be. It evidently belongs to the ultra-visible sort of micro-organisms.

How the *contagium* passes from the sick to the healthy is assumed to be by contact. No experiments have, as far as I am aware, been made as to whether it is conveyed by insects as well; but, as Professor Sir John McFadyean says, as it spreads in all countries and climates and seasons, and the *contagium* is easily carried on the persons or clothes of human beings, it is improbable that insects have anything to do with it.

It is in the methods of protective inoculation that the great advance has been made in our knowledge of this disease. Ten years ago no means were available to stay the progress of this plague; now it has lost its terrors. As soon as it appears it can be immediately attacked and stamped out. This is done by rendering the surrounding cattle immune to the disease by injecting immune serum. This serum is prepared by taking immune cattle and hyper-immunising them by the injection of large quantities of virulent blood, so as to make their blood serum as anti-toxic as possible. If there are no immune cattle at hand, cattle can be immunised by Koch's bile injection method and then hyper-immunised; but, of course, in practice—for example, in the Transvaal—large quantities of immune serum are kept ready for emergencies, and a herd of immune cattle kept up for the supply of the serum. This satisfactory state of affairs, as far as this disease is concerned, is, of course, the outcome of an immense amount of thought and experiment, and I have already mentioned the chief scientific men to whom this country owes this great boon.

Different methods of immunising have been tried during these years. Up to 1903 the prevailing custom was to use what was known as the virulent-blood and serum method. That is to say, immune-serum and virulent-blood were injected at the same time, in order that the animal might pass through a modified attack of the disease. Since 1903, however, in the Transvaal this method has been stopped, and the "serum alone" method introduced. This method is based on the fact that the virus of rinderpest does not retain its infective property outside the body for more than a day

or two; that it dies out in the animal, as a rule, in fourteen days, but in chronic cases only after thirty days, and that therefore the healthy cattle in an affected herd must be protected for this length of time. Now "serum alone" only protects for about ten days, and therefore the cattle must be inoculated three times at intervals of ten days. The doses of serum must also be large—from 50 cc. to 200 cc.—so that this method of stamping out rinderpest, although quite efficacious, entails a good deal of labour.

(2) *Horse-sickness.*

The next stock plague I would bring before your notice is horse-sickness. This is a disease which only affects equines—the horse, mule and rarely the donkey. It is a very fatal disease, carrying off thousands of horses every year. It is one of the most important diseases in South Africa, and, if it could be coped with, would enable the Transvaal to become one of the best horse-breeding countries in the world. At present it is dangerous for anyone in Natal and many parts of the Transvaal to possess a valuable horse, the chances of losing it by horse-sickness being so great.

In 1895, when I went to the north of Zululand with the Ingwavuma Expedition, we lost all our horses with this disease. We started with a hundred horses, and had to march back on foot, every horse having died.

Ten years ago, when I arrived in South Africa, our knowledge of this disease was confined to the disease itself; nothing was known as to its causation or prevention. Credit is due to Dr. Edington for having accurately described the lesions and shown its ready inoculability, period of incubation, &c. He, however, fell into the mistake of attributing its causation to a species of mould fungus.

Etiology : Geographical Distribution.—Horse-sickness is widely distributed throughout Africa. It is common in Natal, Zululand, the greater part of the Transvaal, Rhodesia, Bechuanaland and Portuguese East Africa. In Cape Colony it occurs in epidemics, with intervals of ten to twenty years. It is undoubtedly a disease which prevails chiefly in *low-lying localities* and valleys, and is but rarely met with in elevated exposed positions. It, however, is met with now and then in river valleys up to an elevation of some thousands of feet. *Season* has also a remarkable influence on its development, being exceedingly common in summer and disappearing on the appearance of the first frosts of winter.

Ten years ago various theories were held as to the cause of this disease. Some people thought it was due to eating poisonous herbs; others, to some peculiarity or state of the night atmosphere; others, to eating grass covered with dew, and still others, to the eating of the spiders' webs which may be seen on the grass in the morning. It was known at that time not to be contagious in the ordinary sense of that term; that is to say, a horse could be stabled alongside a case of horse-sickness without incurring the disease, or a horse might be placed without danger in the same stall in which a horse had recently died of horse-sickness.

Nature of the Disease.—A horse which has been exposed to infection shows no signs of the disease for about a week. Its temperature then goes up rapidly, and it dies after four or five days'

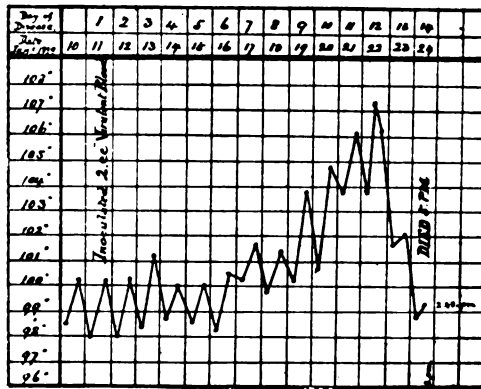


FIG. 8.

illness (fig 8). Very often the horse appears perfectly well until within a few hours of death. For example, my horse was the last one to die on the Ingwavuma Expedition. On the day of his death I rode him until noon without noticing anything amiss. He then became rather dull in his movements, and I handed him over to the groom to lead. He died that evening, immediately after we got into camp. It is, therefore, a very rapidly fatal disease, and almost every horse which is attacked by it succumbs. I have never seen a case of horse-sickness which had been brought on by artificial inoculation recover. But there can be no doubt that a small percentage of horses infected naturally do recover, and these recovered horses are, more or less, immune in future to the disease. There is no necessity for me to describe the symptoms of this well-known disease, as everyone who has to do with horses

for years. Or, again, the germ of horse-sickness is so resistant to external agencies that if, as described by McFadyean, a part of the liver of a horse dead from horse-sickness be buried in the ground and subjected to putrefaction, it is found that the liver tissue retains its infectivity for months. Although a very small quantity of blood introduced under the skin of a horse will almost certainly give rise to the disease, it is quite different if the blood is introduced into the stomach. In the latter case a small quantity of blood has no effect, and the horse requires to be drenched with a pint or more before the disease can be given in this way.

The question now arises as to how horses are infected by this disease in Nature. On account of the small quantity of blood which will give rise to the disease if injected under the skin, and the large quantity required before the disease can be conveyed through the stomach, for a long time it has been supposed that it must be conveyed from sick to healthy horses by means of some biting insect. Experiments have been made within the last few years by Watkins-Pitchford and others, in order to clear up this aspect of the question. Horses have been placed in fly-proof shelters in exceedingly unhealthy places, and it was found that in no case did any of these protected horses incur the disease; whereas horses allowed to feed in the same place, but without any shelter, soon succumbed to the disease. But up to the present, as far as I am aware, the particular biting fly, mosquito, or other insect which is the carrier of this disease, has not been discovered, and there can be no doubt that one of the most important facts to make out in the etiology of this disease is the discovery of the particular insect which conveys the disease from the sick to the healthy. By this discovery a flood of light may be thrown on the causation of the disease, and some means discovered of combating it through the insect, as has been successful in some instances in regard to the case of human malaria. Professor McFadyean also suggests that experiments are needed to show what is the "reservoir" of the virus.

Prevention.—Although we have been unfortunate up to the present in not being able to make out the exact nature of the parasitic cause of this disease, or to discover the exact insect which carries it, a large amount of patient persevering work has been done within the last ten years in regard to its prevention by protective inoculation. In this important work Bordet, Edington, Koch, Theiler, Watkins-Pitchford and others, have laboured for many years, and according to recent reports, with some measure of success.

Dr. Koch has lately recommended a method of immunisation against horse-sickness. This is the artificial establishment of an active immunity in susceptible animals by gradually increased doses of virulent blood, alternated in the early stages of treatment with the injection of serum prepared from the blood of highly fortified salted horses. Mr. Gray reports that the experiments already conducted on these lines show that the process, as laid down by Koch, requires important modification before the process of establishing immunity against horse-sickness can be of any practical use.

Mr. Watkins-Pitchford, in Natal, is also hopeful of succeeding in producing immunity against horse-sickness.

Dr. Theiler, too, reports that he has succeeded in producing a serum which can be utilised in connection with virulent blood to confer active immunity. He informs me that his method is a subcutaneous injection of serum and an intra-jugular injection of virus carried out simultaneously. The death-rate in mules, from the effect of the inoculation, he states to be about 5 per cent. It is higher in horses, but he expects shortly to attain the same result in them. During the last horse-sickness season he exposed 200 immunised mules to natural infection in various parts of the country. Of that number only one died with symptoms of horse-sickness.

The man who discovers a practical method of dealing with horse-sickness will be one of the greatest benefactors of this country. There has always been a tradition that a large money reward is awaiting this discovery. I do not know whether this is well founded or not, but certainly such a work would well deserve the highest possible reward. The best reward is to give the successful investigator more opportunity and more assistance in pursuing his beneficent work. The reward given by the French people to Pasteur was the Pasteur Institute; by the German Government to Koch, the Imperial Hygienic Institution.

(3) *Catarrhal Fever of Sheep: Blue Tongue.*

This disease was first described by Hutcheon, the Chief Veterinary Surgeon of Cape Colony. It is very similar in many respects to horse-sickness. Both these diseases occur most often in low-lying, damp situations, such as river valleys and the coast plain. They also occur at the same time of the year, that is, from January to April. Blue tongue, like horse-sickness, is probably carried from the sick to the healthy by means of some night-feeding

insect. At the same time the diseases are not identical, since the inoculation of horse-sickness blood into a sheep does not give rise to blue tongue, nor the blood of the sheep injected into the horse give rise to horse-sickness.

To Mr. Spreuill, Government Veterinary Surgeon in Cape Colony, acting under the advice of Hutcheon, is due the credit of proving that a preventive serum could be prepared capable of immunising sheep against this disease. Dr. Theiler informs me he has repeated Mr. Spreuill's experiments, and they hope to introduce this method of inoculation at an early date.

(4) *Heart-water of Cattle, Goats and Sheep.*

This disease was also first clearly described by Mr. Hutcheon. It occurs in the Transvaal, Natal and Cape Colony, and is responsible for much of the yearly loss among cattle, sheep and goats.

Like the last disease—blue tongue—it resembles horse-sickness in many ways, and, in fact, has been described by Dr. Edington as being identical with it. Like horse-sickness, it is a blood disease with an invisible parasite, and blood injected under the skin of susceptible animals gives rise to the disease. One difference between the parasites of the two diseases is, that whereas that of horse-sickness is contained in the fluid of the blood, that of heart-water is probably restricted to the red blood corpuscles. The serum separated from the blood is incapable of giving rise to the disease, and the straw-coloured pericardial fluid, when injected into susceptible animals, also fails to give rise to any symptoms of the disease. Horse-sickness blood filtered through a porcelain filter is still infective; the opposite holds good up to the present with heart-water. Horse-sickness blood can be kept for years without losing its virulence; heart-water blood loses it in forty-eight hours.

Heart-water has a peculiar distribution, being restricted to certain tracts of country with a warm, moist climate. It is known to farmers that if they remove their flocks to the high veld the disease dies out. To Lounsbury is due the credit of explaining these facts. He found that the disease is carried from sick to healthy animals by means of the bont tick, *Amblyomma hebraeum*. This tick leaves its host between each moulting, and a larva which sucks the blood of an infected animal is capable of giving rise to the disease in a susceptible animal either as a nymph or imago.

The distribution of this tick corresponds to the distribution of the disease. If this tick could be killed off, the disease would disappear from the country. This could doubtless be done on individual farms by long-continued dipping; but in the meantime some method of immunisation might be devised.

REPORTS OF THE COMMISSION APPOINTED BY THE
ADMIRALTY, THE WAR OFFICE, AND THE CIVIL
GOVERNMENT OF MALTA, FOR THE INVESTIGA-
TION OF MEDITERRANEAN FEVER, UNDER THE
SUPERVISION OF AN ADVISORY COMMITTEE OF
THE ROYAL SOCIETY.

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(Continued from p. 115.)

REPORT ON THE PREVALENCE OF MEDITERRANEAN FEVER
AMONGST BRITISH TROOPS IN MALTA, 1905.

BY LIEUTENANT-COLONEL A. M. DAVIES.

Royal Army Medical Corps ; Member of the Mediterranean Fever Commission.

SECTION II.

§ 1.

THE following table shows the incidence of Mediterranean fever
in the different barracks and hospitals in Malta during the nine
months January to September, 1905 :—

TABLE I.

	Average population	Number of cases	Ratio per 1,000
Upper St. Elmo	392	26	66·33
Lower St. Elmo	613	84	137·03
Floriana	717	37	51·60
St. Francis	201	9	44·77
Manoel	474	29	61·18
Tigne	492	31	63·01
St. George's	1,051	42	39·96
St. Andrew's (four months)	624	15	54·00*
Verdala	618	18	29·13
Cottonera Lines	779	44	56·48
Ricasoli	639	15	23·47
Imtarfa	856	35	40·88
Various Barracks	650	28	43·08
Ghain Tuffieha Camp	473	4	8·45
Various Camps	—	14	—
Valletta Hospital	231	33	142·86
Cottonera Hospital	147	17	115·65
Various Hospitals	157	6	38·22
	9,114	487	—

* Ratio calculated for nine months ; the actual ratio for four months was 24·04.

The occupation of these barracks is as follows :—Upper St. Elmo
(old buildings), Tigne (principally huts and new buildings), and

Ricasoli (old buildings) are occupied by Royal Garrison Artillery, of which there are eight companies (having an average strength of about 200 each), and a district establishment amounting to about another 200. Three companies are stationed at Tigne and outlying forts to the west; three companies at Ricasoli and outlying forts to the east; and two companies at Upper St. Elmo and St. James Cavalier. There has been little variation in the strength of the Royal Artillery during the year, which in January was about 2,000, except a reduction during April to about 1,800.

St. Francis is occupied by Royal Engineers, who have a total strength of about 380, many living in detached quarters; the numbers have not changed during the year.

Infantry battalions are accommodated in the old barracks of Lower St. Elmo, Floriana and Verdala; in the new barracks of St. George's, St. Andrews, and Imtarfa; in Manoel, which is partly an old fort and partly a hutment. Another battalion occupied until lately various old fortress barracks known collectively as the Cottonera Lines; and a detachment occupies Fort Chambray in Gozo. Several changes have occurred in the *personnel* of the infantry during the year. In January the battalions present were the Sussex, Hants, Essex, West Kent, Rifles, Dublin Fusiliers, and Rifle Brigade, each from 900 to 1,000 strong; and a wing of the Yorkshire Light Infantry, 500 strong. These last and the Rifles left the island in March, and the headquarters and five companies of the Sussex left in May. In February the Lancashire Fusiliers arrived, about 700 strong, being increased by about 100 in March. During April all the battalions were reduced in strength, the Essex and Rifle Brigade losing about 150 each, the West Kent and Dublins about 100 each, the Sussex and Hants about 50 each; so that during the five months, May to September, their strength was between 800 and 900, except the Hampshires, which remained at 1,000.

The Departmental Corps occupy Marsamuscetto and Old Laboratory Barracks, the various hospital quarters and hired quarters in different parts. The total combined strength has not varied, being about 350.

Valletta and Citta Vecchia Hospitals are old buildings, Cottonera and Gozo are modern, Imtarfa is a quite new building, and Forrest is an old hired house, not built for a hospital, but now many years in occupation as such.

Ghain Tuffieha is a permanent camp for Mounted Infantry, with an average strength of 180; and also accommodates battalions

under training at different times during the cold season. Pembroke is a standing musketry camp, with a floating population, and Mellieha and other camps are occupied from time to time for field training.

An examination of Table I. shows that the incidence of Mediterranean fever during the first nine months of 1905 has varied considerably in different localities. A total of 487 cases in a population of 9100 gives a general ratio, for the period, of 53·52 per 1000; this varies in different places between 8·45 at Ghain Tuffieha Camp and 142·86 at Valletta Hospital. Arranged according to the severity of prevalence, the different barracks, &c., stand as follows:—

	Attack ratio per 1,000.		Attack ratio per 1,000
Valletta Hospital ..	143	St. Francis ..	45
Lower St. Elmo ..	137	Various barracks and camps ..	43
Cottonera Hospital ..	116	Imtarfa ..	41
Upper St. Elmo ..	66	St. George's ..	40
Tigne ..	63	Various hospitals ..	38
Manoel ..	61	Verdala ..	29
Cottonera Lines ..	56	Ricasoli ..	23
St. Andrew's ..	54	Ghain Tuffieha Camp ..	8
Floriana ..	52		

The items "Various barracks and hospitals," and "Cottonera Lines," including many detached forts and buildings, should be disregarded in this list, the numbers occupying any individual locality being too small to enable any safe conclusion to be drawn as to factors in causation. The following points call for explanation:—

(1) The excessive prevalence of the disease in the two hospitals at Valletta and Cottonera, and in the barracks at Lower St. Elmo; (2) the relative immunity of Verdala, Ricasoli, and Ghain Tuffieha; (3) the difference in prevalence between the adjoining barracks of Lower St. Elmo (137 per 1,000) and Upper St. Elmo (66 per 1,000), the buildings of which are within a few yards of each other.

The next table (II.) shows the relative incidence in the different barracks and hospitals month by month. It is seen (1) that Mediterranean fever, present to a slight extent in January and February, increased in March, and again very considerably in May, the increased number of cases continuing with no diminution during the rest of the hot weather; and this in spite of the fact that the strength of the troops was decreased by about 800 in April, and again by about 600 in May. (2) It is also seen that the disease did not prevail throughout the island generally with the same degree of intensity at any one time; thus at Floriana there were nine cases

in March, no other barracks showing more than three or four cases in this month ; after April very few cases occurred at Floriana. In May there were 11 cases in Manoel and 17 in Lower St. Elmo ; but though Lower St. Elmo continued to be severely affected throughout the summer, Manoel was practically free after June. St. George's had few cases until June, and Imtarfa few until August. There was therefore a very uneven distribution of cases, month by month, which appears to contraindicate any one general condition, climatic or other, affecting the whole barrack population.

TABLE II.—DISTRIBUTION OF MEDITERRANEAN FEVER CASES, 1905.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Total
Upper St. Elmo ..	—	2	4	4	4	5	4	—	3	26
Lower St. Elmo ..	2	—	3	6	17	19	15	10	12	84
Floriana ..	2	4	9	7	2	3	4	3	3	37
St. Francis ..	1	3	2	—	—	1	1	—	1	9
Manoel ..	1	—	3	4	11	7	—	1	2	29
Tigne ..	—	2	4	1	7	1	6	3	7	31
St. George's ..	1	—	1	—	5	10	5	15	5	42
St. Andrew's ..	—	—	—	—	—	—	3	5	7	15
Verdala ..	—	2	1	1	—	5	1	4	4	18
Cottonera Lines ..	2	4	7	3	4	5	13	4	2	44
Ricasoli ..	—	1	—	—	2	3	2	7	—	15
Imtarfa ..	1	1	1	2	2	3	1	14	10	35
Various barracks ..	—	—	1	2	4	2	2	6	11	28
Ghain Tuffieha Camp ..	—	—	—	2	—	—	—	1	1	4
Various camps ..	—	—	4	4	2	—	—	2	2	14
Valletta Hospital ..	2	—	1	2	5	6	7	6	4	33
Cottonera Hospital ..	—	—	—	—	6	5	1	3	2	17
Various hospitals ..	—	1	—	—	—	—	2	2	1	6
	12	20	41	38	71	75	67	86	77	487
Strength	10,225	10,329	9,853	9,471	8,661	8,025	7,984	7,881	7,855	—

Table III. shows the incidence of the disease amongst the different corps stationed in Malta during the first nine months of 1905.

An examination of this table shows that the incidence varied considerably in the different corps. The general ratio throughout the troops has already been stated as 53·52 per thousand for the period : arranged according to severity of prevalence, the corps stand as follows, only those present throughout the whole period being considered :—

	Attack ratio per 1,000.		Attack ratio per 1,000.
Royal Army Medical Corps ..	194	Royal Dublin Fusiliers ..	46
Army Pay Corps ..	143	Royal Garrison Artillery ..	45
Essex	88	Royal West Kent ..	45
Army Ordnance Corps ..	62	Royal Engineers ..	33
Rifle Brigade	54	Hampshire	27
Royal Sussex	48	Army Service Corps ..	26

The respective numbers of the Army Service, Ordnance, and Pay Corps are so small that it would not be safe to draw any conclusions from them. The points that call for explanation are (1) the excessive prevalence of the disease amongst the R.A.M.C. and the Essex Regiment, and (2) the relative immunity of the Hampshire Regiment and the Royal Engineers.

TABLE III.

	Average strength	Number of cases	Ratio per 1,000
Royal Garrison Artillery.. ..	1,941	88	45·34
Royal Engineers	363	12	33·06
1st Lancashire Fusiliers (7 months) ..	815	51	62·58*
2nd Royal Sussex	642	31	48·29
2nd Hampshire	997	27	27·08
2nd Essex	951	84	88·33
1st Royal West Kent	827	37	44·78
2nd Yorkshire Light Infantry (3 months) ..	539	—	— †
1st King's Royal Rifles (2 months) ..	1,043	2	1·92‡
1st Royal Dublin Fusiliers	900	41	45·56
1st Rifle Brigade	849	46	54·18
Army Service Corps	76	2	26·32
Royal Army Medical Corps	155	30	193·55
Army Ordnance Corps	80	5	62·50
Army Pay Corps	21	3	142·86
Miscellaneous	—	2	—
Cases occurring in hospital (not R.A.M.C.)..	—	26§	—
	—	487	—

* The Lancashire Fusiliers arrived on February 27th; the ratio is for the actual period of seven months; assuming the same rate of prevalence, the ratio would be 80·46 for nine months.

† The Yorkshire Light Infantry left in March.

‡ The King's Royal Rifles left in February; the ratio is for two months.

§ These are not included in the regimental figures, because removed from regimental conditions.

Table IV. gives the prevalence, month by month, amongst the several corps, and shows generally the same aspect of the epidemic as Table III., with which it may be compared.

§ 2.

More particular attention may now be directed to certain places where Mediterranean fever has been especially prevalent, with a

250 *Reports of the Commission on Mediterranean Fever*

view to eliciting any circumstances that may throw light on this excessive prevalence.

Lower St. Elmo Barracks show the greatest incidence of any place, excepting the two hospitals of Valletta and Cottonera. The sanitary conditions of these barracks are shortly stated in Section I.; the water supply and drainage are in the main satisfactory, but the construction is very insanitary; the men are accommodated in casemates, fifty-two feet in length, with very inadequate ventilation; the situation of the barracks, which are sunk in a hollow, is also such as to render the supply of fresh air a difficulty at all times, and practically an impossibility in calm and still weather.

TABLE IV.—REGIMENTAL INCIDENCE OF MEDITERRANEAN FEVER CASES, 1905.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Total
Royal Garrison Artillery ..	—	4	8	6	14	11	13	16	16	88
Royal Engineers	2	3	2	—	1	1	1	1	1	12
1st Lancashire Fusiliers ..	—	—	—	6	5	4	10	12	14	51
2nd Royal Sussex	2	4	7	2	2	4	1	4	5	31
2nd Hampshire	—	2	3	2	1	5	4	4	6	27
2nd Essex	2	—	3	6	18	19	16	14	6	84
1st Royal West Kent ..	1	4	8	8	2	3	4	3	4	37
2nd Yorkshire Light Infantry	—	—	—	—	—	—	—	—	—	—
1st King's Royal Rifles ..	1	1	—	—	—	—	—	—	—	2
1st Royal Dublin Fusiliers..	1	—	1	—	4	10	5	15	5	41
1st Rifle Brigade	1	1	6	5	11	7	3	5	7	46
Army Service Corps	—	—	—	—	1	—	—	—	1	2
Royal Army Medical Corps	1	—	1	1	3	4	7	10	3	30
Army Ordnance Corps ..	—	—	1	1	1	—	—	—	2	5
Army Pay Corps	—	—	1	—	—	—	—	—	2	3
Miscellaneous	—	—	—	—	—	—	—	1	1	2
Hospital cases (not R.A.M.C.)	1	1	—	1	8	7	3	1	4	26
	12	20	41	38	71	75	67	86	77	487

From the beginning of 1905 until July 8th these barracks were occupied by the 2nd Essex Regiment; on the latter date they moved to Imtarfa, and on July 11th their place was taken by the 1st Lancashire Fusiliers. This change of occupation complicates the matter, but also to some extent helps in the investigation.

The cases of Mediterranean fever in the Essex Regiment were distributed, month by month, as follows:—

January	2	June	19
February	0	July 1st to 8th ..	7
March	3	July 9th to 31st ..	9
April	6	August	14
May	18	September	6

Of these cases all, up to July 8th, were admitted from Lower St. Elmo; with the exception of two in March, admitted from Pembroke Camp; and three in May, one in June, and one in July, which were admitted from Gozo. From July 9th onwards all the cases were admitted from Imtarfa Barracks, except one from Gozo and one from Ghain Tuffieha. It has been already stated that it is necessary to allow a period of fourteen days for incubation in most instances, and that probably a *further period* of fourteen days should be allowed in many instances, between date of contracting infection and date of admission to hospital; cases admitted more than twenty-eight days after departure from any particular place can hardly be considered to be due to infection originating in that place. If this limit be provisionally adopted, the two cases admitted from Pembroke Camp should be referred to Lower St. Elmo, as also should three of the cases admitted from Gozo. *Per contra*, one case admitted from St. Elmo in May, thirteen days after arrival from Gozo, may be debited to the latter place, though, in this instance, some doubt must be felt as to the length of the incubation period.

The 2nd Essex Regiment arrived in Malta from England, and took up quarters in Lower St. Elmo, on April 29th, 1904; here six companies remained throughout the year, except for short periods at Pembroke, Mellieha, and Ghain Tuffieha Camps, returning from the last-named on December 19th, 1904. Two companies were stationed at Gozo (A and B) from April 29th, to September 1st, 1904, on which date they were relieved by D and F Companies, who remained there until May 8th, 1905; being relieved in turn, on that date, by C and E Companies.

Of the total number of cases (fifty-five) occurring in the regiment between January 1st and July 8th, 1905, all, except one, belonged to the six companies stationed at Lower St. Elmo; only this one came from the two companies stationed at Gozo.

The incidence of Mediterranean fever in the different companies during the whole period of nine months, January to September, was as follows:—

A	B	C	D	E	F	G	H	Uncertain	Total
11	15	4	2	3	8	19	19	3	84

The companies that have been stationed throughout the whole time at Lower St. Elmo, and subsequently at Imtarfa, have been A, B, G, H; these four companies have had sixty-four cases; the four companies, of approximately the same strength, that have been part of the time at Gozo (C, D, E, F), have had seventeen

cases; of these seventeen, four were admitted from, and without doubt contracted the fever in, Lower St. Elmo; seven probably contracted the disease there, and four probably at Imtarfa; in two instances only, or perhaps three, was it contracted at Gozo.

It is necessary to distinguish between what is practically certain and what is uncertain. Assuming the correctness of the diagnosis, as to which every care has been taken, there is little doubt that 84 cases of Mediterranean fever have occurred in this battalion. As to the place where infection was contracted, there is no such certainty, because the incubation period has not yet been definitely ascertained. It is a fact to be noted that 64 of these 84 cases occurred in the four companies, A, B, G, H, which remained the whole time in Lower St. Elmo and Imtarfa; in three instances, two of which were from the mounted infantry at Ghain Tuffieha, the company to which the man belonged is not ascertained: of the 17 cases occurring amongst the other four companies, 11 probably originated in Lower St. Elmo. There is therefore a presumption that the excessive prevalence of the fever in this battalion was due to something belonging to, or connected with, Lower St. Elmo Barracks.

These barracks consist of a range of buildings in three stories, the rooms in the lower being used as stores, cookhouse, canteen, &c., and the middle and upper stories being used as barrack rooms. They were allocated thus:—

Upper Storey—

Nos. 1 to 3.—C Company, January 1st to May 6th.

D Company, May 8th to July 8th.

4.—Signallers.

5 to 8.—A Company all the time.

9 to 12.—E Company, January 1st to May 6th.

F Company, May 8th to July 8th.

13, 14.—Drums.

Middle Storey—

Nos. 1 to 4.—B Company	} all the time.
5 to 8.—G Company	
9 to 12.—H Company	
13, 14.—Band	

The actual barrack rooms from which cases were admitted are not always ascertainable with accuracy; the following particulars as to the rooms occupied are as much as I have been able to find out:—

Upper Storey.

Nos. 1 to 4.—Cases were admitted May 9th, 31st; June 2nd (C Company); July 31st (D Company); total, 4 cases.

Nos. 5 to 8.—Cases admitted, March 18th; May 20th, 21st, 31st; June 6th, 7th; July 1st, 5th, 11th; August 4th; total 10 cases (A Company); one other case in this company lived at the sergeants' mess.

Nos. 9 to 12.—Cases admitted April 12th, 22nd; May 1st (E Company); July 13th, 24th, 28th (F Company); total, 6 cases.

Nos. 13, 14.—Cases admitted, May 23rd (H Company); June 10th; July 2nd (G Company); total, 3 cases.

Middle Storey.

Nos. 1 to 4.—Cases admitted January 22nd; March 16th; April 6th; May 2nd, 8th, 19th, 31st; June 2nd, 10th, 21st; July 20th; total, 11 cases in B Company, of which four at least were in No. 2, and three at least in No. 3 room.

Nos. 5 to 8.—Cases admitted January 22nd; April 1st; May 3rd, 26th; June 8th, 10th, 11th, 16th, 21st, 26th, 30th; July 24th, 31st; total 13 cases, all in G Company, of which four at least lived in No. 8 room; two other cases in this company were drummers, living in Nos. 12 or 13, Upper Storey.

Nos. 9 to 12.—Cases admitted March 25th; April 5th, 18th; May 3rd, 20th, 27th; June 5th, 11th, 17th, 28th; July 2nd, 4th, 20th; August 4th (two cases); total, 15 cases, all in H Company; of these at least three were in No. 10, and three in No. 12. One other case in this company occurred in the sergeants' rooms on the Upper Storey.

Nos. 13, 14.—One case occurred, May 6th; Band, F Company.

The above list accounts for 65 out of the 84 cases that occurred in the battalion. After they moved to Imtarfa on July 8th cases continued to occur, and of these 12 have been regarded as probably due to St. Elmo infection, up to August 5th. After this date infection has been considered to have been contracted at Imtarfa, though very possibly introduced from St. Elmo. Three cases were admitted from G Company on August 6th and 7th, which might be thought to be more likely due to a continuance of the same influence, whatever it was, that caused the special incidence on this company, with an extra long period of incubation. Eight other cases occurred up to the end of the month, and six in September, there being a very notable diminution in this month.

Before the arrival of the Essex Regiment at Imtarfa, a few cases had been admitted from the Sussex Regiment, which had been quartered in these barracks since February 22nd. Besides 5 cases in the middle of March, probably dating from Polverista, there had been at Imtarfa one case in March, two in April, two in May, two in June, and one on July 5th; the disease was present, but did not prevail at the station; the average strength of the troops during January to June was 880. No cases occurred in the Sussex Regiment after July 5th until August, in which month there were four admissions from this battalion. Granting that the length of the incubation period is uncertain, if one compares the considerable prevalence of the fever at Lower St. Elmo with its trivial manifestations at Imtarfa during the early part of the summer, it appears more probable that the Essex cases occurring at Imtarfa were due to a "something" brought up with the regiment from St. Elmo than to any infection of local origin at Imtarfa. Whether this supposed infective "something" was brought up as an already ingested but latent *contagium*, within the bodies of the men who afterwards developed the disease, or whether it was introduced in fomites, or infective matters external to the body, is a question to be considered further. At this stage we are, I think, to some extent justified in the presumption that the Imtarfa cases, for at any rate four weeks and possibly longer after arrival at the new quarters, were due not to anything belonging to Imtarfa, but to some factor that had been in operation at St. Elmo, and which continued in operation for some time afterwards. The drop from fourteen admissions in August to six in September is noteworthy.

(To be continued.)

SOME NOTES ON CONTINENTAL SURGICAL PROCEDURE.

BY CAPTAIN F. F. CARROLL.
Royal Army Medical Corps.

PART II.*

TREATMENT.

UNDER this heading I would wish to bring to notice two Continental procedures, the excellence of which does not appear to have received due recognition in this country.

The first of these is Professor Mosetig-Moorhof's method of filling bone cavities with iodoform wax.¹

This distinguished Viennese surgeon has for many years experimented with various substances in the hope of finding a material which, though liquid when introduced, would solidify *in situ*, and produce no irritation in the tissues. The outcome of his labours is a substance which he calls *iodoform-knochenplombe*, and is composed as follows :—

Finely powdered iodoform	60 parts.
Spermaceti	40 „
Oil of sesame	40 „

This compound is solid at room temperature, but becomes liquid on heating to 50° C. It is best kept in long narrow cylindrical bottles fitted with either rubber or glass stoppers. These should be only two-thirds full, as it is essential that when liquefied, by immersing the bottle in boiling water, the mixture should be thoroughly shaken to secure a perfect emulsion, as owing to its greater density the iodoform tends to settle to the bottom.

The technique of its use is not difficult, although some important points must be remembered. The steps in the operation are essentially those employed by a dentist in filling a carious tooth. The bone cavity, usually that left by the removal of tubercular deposits during the operation for excision of a joint, should first of all be thoroughly scraped so as to remove every particle of diseased tissue. It should next be irrigated with a 1 per cent. solution of formalin to get rid of all blood and traces

* Part I. was published in the June, 1906, number of the Journal.

¹ von Mosetig-Moorhof. *Deutsche Zeitschrift für Chirurgie*, Bd. lxxi.

of pus, scrapings, &c., which may have been left behind. The third and most important desideratum is that the walls must be absolutely dry. This can be accomplished by either the electric heater which has been devised by Dr. Silbermark, first assistant to the Professor, or by a very simple contrivance in which air is blown by means of a double rubber bag through two bottles, the first containing a solution of formalin and the second calcium chloride.

The plugging material, which has been rendered liquid by heat and well shaken, can now be poured slowly in. It usually sets *in situ* in a few minutes, and the superficial soft parts can then be united. No drainage is as a rule required. The ultimate fate of the plug is somewhat different if the wound is completely closed or if a sinus has been left. In the latter case the material is extruded by the pressure of the new-formed connective tissue which ultimately fills the cavity, while in the former case it is absorbed and removed by the lymphatic channels of the part and excreted in the urine. The fact that iodoform is an antiseptic and also a fairly strong bactericide hinders suppuration, which would otherwise be very common in cases with sinuses and mixed infection. Iodoform poisoning has never been observed by the Professor or any of his klinik. This is said to be due to the fact that the drug when introduced in this solid form is only absorbed by the tissues with extreme slowness.

Owing to the fact that iodoform gives a black shadow to the Röntgen rays the progress of the case can always be watched and the gradual absorption noted, as the accompanying skiagraphs taken from Professor Mosetig-Moorhof's book very clearly show.

In localities where, owing to its odour, iodoform is objected to, such as cases of disease of the antrum of Highmore, derinatol may be substituted in the same proportions; this substance may also be used in non-tubercular bone disease, such as osteo-myelitis, &c.

The results of bone plugging, especially in tubercular cases, are extremely good.

Another most interesting procedure is the Bier method of employing hyperæmia in the treatment of surgical diseases.¹ Professor Bier, of Bonn, who has spent many years in elaborating his treatment, lays down several fundamental postulates in support of his theory. They are, first, that every generation and regeneration of tissue is accompanied by hyperæmia; second, that every invasion of the tissues by a foreign body, whether bacterial or non-bacterial,

¹ Bier. "Hyperämie als heilmittel." Second Edition, 1905.

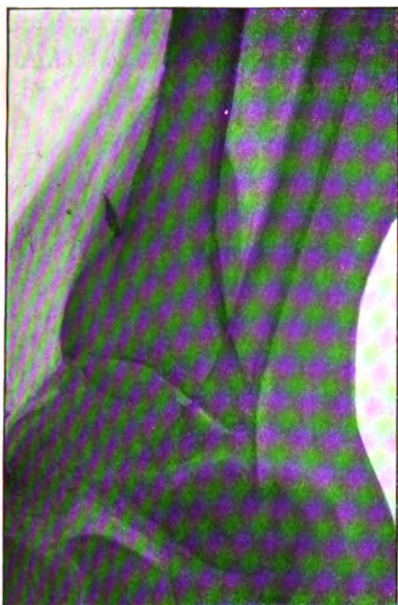


FIG. 1.—A case of osteo-myelitis of the lower end of the tibia before operation.

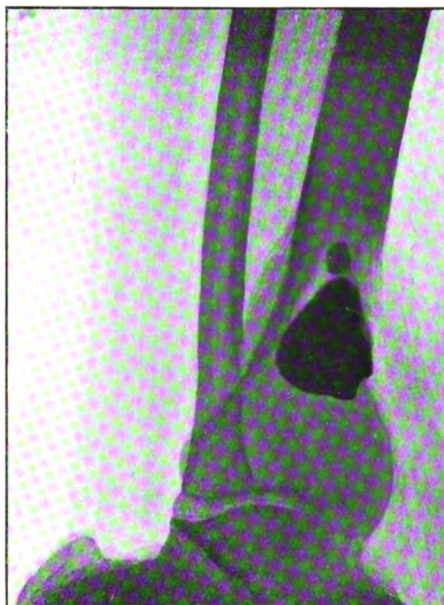


FIG. 2.—The same case with diseased tissue removed and the cavity filled with iodoform wax, two weeks after operation.

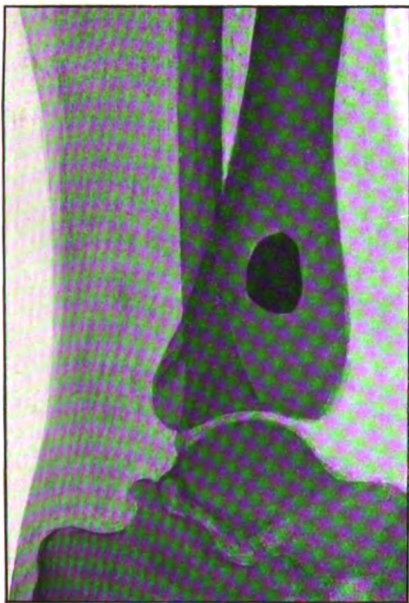


FIG. 3.—Same case twelve weeks after operation.

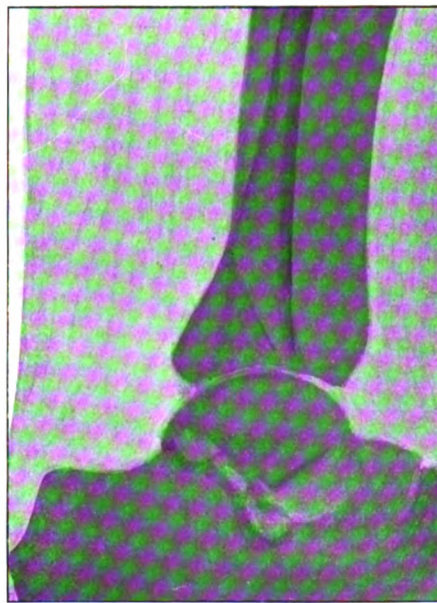


FIG. 4.—Same case thirty-three weeks after operation.

To illustrate article by Captain F. F. CARROLL, R.A.M.C.,
 "Some Notes on Continental Surgical Procedure."

at once calls forth a reflex hyperæmia. Therefore, hyperæmia is Nature's method of repair in all diseased conditions, and if artificially produced will not only aid but enormously hasten the reparative process. He divides artificial hyperæmia into active and passive, and defines the former as that condition where, owing to dilatation of the arteries, the flow of blood to the affected part is increased, and the latter to that condition where, owing to constriction of the veins, the return of blood from the part is materially impeded. Active hyperæmia can be produced by many agents, such as massage, electricity, chemicals and heat.

With regard to heat, Bier has made many interesting experiments, and has come to the conclusion that dry heat in the form of hot air is the simplest, most easily regulated, and best method of employing this remedy.

He uses boxes of different sizes and shapes to accommodate all parts of the body. The boxes, which are usually made in two halves, are simply constructed of wood and lined with felt. If intended for a limb a felt sleeve which projects from each opening is securely fastened round the part with a bandage. Each box is provided with a thermometer graduated to 120° C., which passes through a hole in the lid. The source of heat is usually a Bunsen burner, but any small spirit lamp can be used; this is placed at some distance from the chamber under an inverted funnel, from which the hot air is led to the box by a tin tube, exactly in the same manner as Wyatt's vapour bath is used. Bier recommends that the affected part be kept in the hot air for one hour daily at a temperature of from 80° to 100° C.

Passive hyperæmia is produced by constricting the veins without interfering with the arterial blood flow to any great extent. This end is attained by employing an elastic bandage placed between the seat of disease and the heart, and cannot, of course, be applied to the trunk. The bandage should be of thin rubber, about 3 cm. broad by 2 m. long. In applying it is needful to note carefully the degree of pressure. This should be sufficient to occlude the veins, but should leave the distal pulse unimpaired. A little practice is necessary before the right amount of tightness is found.

Bier himself lays down the following rules:—

(1) If the bandage has been properly applied the limb will be found to become uniformly swollen from the edge of the bandage to the periphery, and to show at the same time a bluish-red colour. At first the subcutaneous veins swell and the skin becomes bluish, then after about half an hour the colour changes to bluish red.

(2) If the limb does not become blue it is a sign that the band has been applied too tightly and that the artery is also compressed.

(3) The best indication that the bandage has been properly put on is that in a few minutes the patient will cease to feel any pain in the part; if too tight the pain will be increased, if too slack it will be undiminished.

(4) The bandage should be allowed to remain on the limb for from twenty to twenty-two hours. Then taken off for four hours and reapplied. In the interval the limb should be raised so as to cause absorption of the œdema.

The surgical diseases which have been found to benefit most by passive hyperæmia are all acute inflammatory conditions of the skin and connective tissue, such as boils, septic wounds, whitlows, &c., inflammation of the tendons and their sheaths, inflammation of the long bones, including septic periostitis, osteomyelitis, &c.; all forms of arthritis, whether tubercular, gonorrhœal, or septic. Hot air is most useful in more chronic conditions, such as stiff joints, rheumatic arthritis, sciatica.

I hope, in a later number, to publish the results of these procedures as employed personally in military hospitals.

THE HUMOUR OF INDIAN SANITATION.

BY COLONEL R. H. FORMAN.

Royal Army Medical Corps.

To the casual observer there does not appear to be anything in the nature of a burlesque touch about sanitation—Indian or any other—yet the “casual observer,” as the term implies, is but a purblind individual and prone, like his twin-brother, “the man in the street,” to allow the obvious to escape his cognisance. It is with considerable diffidence, bordering closely on fear, that I venture to submit this aspect of the subject to the consideration of the readers of the ROYAL ARMY MEDICAL CORPS JOURNAL, and my temerity appears all the greater when I turn over the back numbers and note the ultra-scientific and severely erudite tone which characterises all its contributions. Moreover, being a Scotsman, I “jok’ wi’ deefeeeculty,” and yet I have the advantage of precedent, that fetish so dear to officialdom, in that I have actually seen a joke in the columns of the *British Medical Journal*, albeit relegated to the small-typed *ultima thule* of “Answers to Correspondents.” Moreover, I have reason to believe that Cerberus for the nonce is absent pursuing the filaria or some other harassed parasite, and mayhap the Sub-Editor may be caught napping and permit this article to sully his pages.

“The Senior Executive Medical Officer is, *ipso facto*, the Sanitary Officer,” so runs that monument of legal luminosity, the Indian Cantonment Code. Judged from the standpoint of our friend the “casual observer,” there is nothing more to be said—all is perfect in a perfect world—there is a majestic sweep about it, an absence of hiatus, an axiomatic finality, which precludes cavilling; yet—it is with pain I say it—one thing is lacking, it is not practical. I have, for my sins, been that somewhat nebulous official, a Senior Executive Medical Officer, and I know. Be it distinctly understood, however, that what I have to say bears no reference to those Archangels of the Goddess Hygeia, Command Sanitary Officers; I know some of them; I can even claim to be on terms of intimacy with a Headquarter one, a man whose very speech is prophylactic and the glance of whose eye is aseptic, and I would not presume to question their omniscience. Have I not, in common with others, studied fearsome drawings of enteric-proof

latrines and revelled in poetic descriptions of the innocuous disposal of excreta? No! I fly at a lower altitude and confine myself to that "catch-the-censorious-eye," the Cantonment Sanitary Officer. Of a truth it is a world of make-believe, and nowhere more so than in this "land of regrets." We are a practical people—save the mark—but what little of practicality remains appears to vanish altogether when we become enveloped in the Eastern environment and we substitute for Western matter of fact the metaphysical, hair-splitting inconsequence of the Orient. Presumably of old, if Pharaoh did not give the Israelites straw with which to make bricks, he provided some sort of a substitute; but the secret of the unknown is apparently evolution, and in these more modern days we are content to provide merely a name. It is certainly economical whatever else may be said for it, and I do not observe in the *Indian Budget* any vote to cover the occult proceedings of that *placebo* to public opinion, the Cantonment Sanitary Officer. What's in a name? Apparently a lot in the East, for that is his whole capital, and before it the cholera vibrio trembles and the *Bacillus typhosus* flees away.

I recollect at one time when acting in that capacity in a cantonment, that shall be nameless, a fatal case of cholera occurred. The victim was a leading barrister; he was also an enthusiastic officer of volunteers. In this latter capacity we paid him all due respect and gave him a military funeral. It was a big place, and because of the official function I heard of his demise and the cause thereof. The irony of the thing struck me forcibly, and the following day, whilst the sarcastic mood was still on me, I wrote to the Cantonment Magistrate officially, to the effect that it had come to my knowledge, "through the medium of the public press," that a case of cholera had occurred in such and such a locality, and requested to know what steps had been taken to trace the source of the disease and prevent its recrudescence. I duly informed him that I was his "obedient servant," and added after my signature the zymotic-destroying shibboleth, "Cantonment Sanitary Officer." I forget what the answer of the Cantonment Magistrate was; in fact, I am not at all sure that he did not treat my impertinent and presumptuous curiosity with the contempt which it so eminently deserved; anyhow, I began to have grave doubts as to the efficacy and awe-inspiring nature of my official patronymic, and being full of zeal—we all get afflicted that way at times—I deemed it incumbent upon me to find out, statistically, a little concerning the somewhat heterogeneous, not to say unsavoury, population committed (on paper) to my charge. Accordingly, I paid a visit

to my friend the Cantonment Magistrate, who, as every Indian official knows, is the keeper of all the archives—vital, financial, legal, everything. I was received with the greatest cordiality—it is a part of the routine—and referred to the second, third, or fourth clerk whose business it was to record these immaterial matters. With Eastern unctuousness and with a gleam of self-appreciation, plus the possibility of a laudatory “chit,” in his eye, he produced a ponderous tome neatly ruled in columns—number, age, sex, name, disease, and all the rest of it. Naturally I turned to the column, “Cause of death,” and the first entry under that heading was “belly-painings,” the second “plenty much old.” Bred as I have been to stick slavishly to the Nomenclature of Diseases, as propounded by the Royal College of Physicians, it must be confessed that such diagnostic fireworks were disappointing, not to say startling, and that my new-born enthusiasm for “the good of the community at large” sustained a severe check. I left, and for the remainder of my sojourn in that cantonment confined my efforts to trying to rub it into the thick head of Tommy Atkins that the reckless pursuit of contagious disorders was neither conducive to longevity nor likely to facilitate his return to his ‘appy ‘ome.

But even an Indian Government, by fortuitous chance, nets at times an “*ipso facto*-wallah,” who rises to the occasion and justifies his existence, earning in common with certain other dignitaries in this sunny land the right to be designated “heaven-born.” One such I remember in the far-off days of my callow youth, whose energy and enthusiasm were unbounded, and whose horror of self-advertisement was a disease. At the risk of repeating a well-known tale I must relate the incident, for it will bear repetition. Long ere Koch’s “comma” sailed above the horizon of research, cholera was a frequent visitant to a certain military station, which also shall be nameless, and our friend was quartered therein. Casting about for means to combat it, and handicapped by the modesty which is an invariable accompaniment of true genius, he was yet unable to find any way, other than the public press, to promulgate his highly original ideas and save his fellow-creatures from the danger which menaced them. He consequently wrote a letter to the editor of the *Pioneer*. The gist of that letter was that it was dangerous to eat the cucumber when cholera was so rife, because it belonged to the natural order *Cucurbitaceæ*, to which such deleterious plants as elaterium (and others duly mentioned; my botany is shaky nowadays and I forget) also belonged, and that the analogy was obvious. To some of us less gifted this appeared to be rather of the

nature of a *non sequitur*, and I regret to add that certain officers, in the ribaldry of ignorance—they are now reverend seniors in the Corps, but not even wild horses would compel me to hint at their personality—replied thereto in the columns of the same paper, with a levity which was as unbecoming as it was reprehensible. Adopting *verbatim et literatim* the phraseology of the original scribe, but substituting the potato for the cucumber, they pointed out that the former belonged to the natural order *Solanaceæ*, to which tobacco and other deleterious plants also belonged, and that therefore to eat the potato was to court disaster. When this second letter was published, a wave of sadness swept over the North-West Provinces and the Punjaub.

Mais revenons à nos moutons. When I was transferred from the cantonment famed for its babuesque (if I may coin a word) health statistics I found myself Senior Medical Officer of Bangalore, and therefore *ipso facto* yet once again. Now Bangalore is not a cantonment, but is termed “the civil and military station”: therefore my duties were confined to the troop lines, and consequently I expected to find here, if anywhere, stern and rigid sanitary systematisation, practical prophylaxis, and impregnable hygienic precautions; especially so as the station has an unsavoury reputation as regards the enteric scourge. I am old enough now to be patient and resigned when fond hopes are not realised. How we did fight that enteric microbe, and how persistently he turned up again smiling and mocked our puny efforts. Yet, on looking back, it seems to me that there is little difficulty in accounting for the immortality of the Bangalore *B. typhosus*; when numerous latrines with mud floors inches deep in dust, planted for preference in close juxtaposition to cook-houses and, when practicable, to windward; when the creaky, decrepid Crowley cart wobbles on errant wheels through the lines, emulating in its progress the municipal water-cart, and distributing its malodorous contents with a superabundant and praiseworthy impartiality; when to destroy the breeding media of the *Musca domestica* is wicked, or to hunt the peripatetic ghowli criminal, it is small wonder that in the lines of an ordinary British regiment the bacillus finds an environment eminently suited to perpetual proliferation. We boiled the water—by order, I may add—with a persistence wholly admirable, and the “bhistie” contaminated it immediately thereafter with an equal persistence; we stored it in filter receptacles religiously locked, when the corporal in charge did not forget—on one occasion I found some lively mosquito larvæ in the sterile water—and we did any-

thing and everything that fussiness could suggest or inconsequence indicate. It mattered not one iota that no man ever dreamt of drinking the nauseous tepid compound, were we not *ipso facto*ing à l'Indienne, discounting the prying curiosity of some globe-trotting M.P., and placing in the hands of the Secretary of State a crushing rejoinder to any awkward question.

It is customary amongst geologists to speak of the "Stone-Age" in human evolution, and so may the future historians speak of this as the "Wire-Gauze-Age" in Indian sanitation. The fiat has gone forth and we must cover our kitchen doors and windows with wire-gauze and construct wired hanging meat-safes with through ventilation in the walls. *Sikar kahukin hai*, and forthwith it is done. Ostensibly this is meant to defeat the ubiquitous fly, and so it would if there was not in most cook-houses a foot or two of space between the side walls and the roof to permit of smoke exit. Indian sanitary science has not yet reached that point of perfection which can insist on the fly using the door only and wiping his feet on the door-mat before entering. Chimneys also, where existent, are merely ornamental luxuries and provided apparently for nesting purposes for crows and pigeons, so that, when the above-mentioned hiatus between walls and roof is not present, the exclusion of the flies, by means of automatically closing wired doors and windows, means asphyxiation of the cooks. Now native cooks are human after all, though judging by some of their vagaries we might not think so, and they have a rooted objection to being choked. Many a time when detecting these doors jammed open have I been betrayed into hasty comments not strictly in consonance with either the letter or the spirit of the law as laid down in King's Regulations for the guidance of superiors when dealing with subordinates; nevertheless, though outwardly objurgatory, inwardly my sympathies were with "Poona-swamy"—poor blundering helot that he is—he will gladly carry out the orders of the sahib, mad though he thinks we all are, but there is a limit to endurance, and he draws the line at martyrdom—who shall blame him?

So also with hanging meat-safes. The M.W.D., with that lofty superiority which so eminently characterises it when a mere doctor dares to express an opinion on sanitary science, constructed them in due course, on the sunny side for choice, with formidable looking hooks for hanging purposes, right through the wall, and with nice gauze covering within and without. What more could the most exacting D.P.H. want? It is a funny place this said India. It never seems to have occurred to any one that no meat is hung in

cook-houses, but that it is invariably, and necessarily, brought direct from the ration-stand, chopped up forthwith and put in the pot. And there stand the meat-safes, a sort of sanitary practical joke, in which "Poonaswamy" hangs a belated and scraggy chop on gala inspection occasions, but at ordinary times utilises as a wardrobe.

Many other points occur to me equally with a ludicrous side to them. The disposal of kitchen sullage, for instance, specially designed apparently in many places to attract and nourish flies in close proximity to the cook-houses; the youthful and conscientious enthusiast wandering around with a quart bottle of kerosene in the midst of the Noachian deluge of the monsoon, his ostensible object being the destruction of *Anopheles* larvæ, and so on. This last reminds me of a solemn rite I saw performed at Naples a few years ago by the Port Health Officer on a 5,000 ton British Indian liner homeward bound from India, and therefore plague suspect. The said officer informed me that he was an expert on plague, and that he had even been to Bombay to study it. He was an apt pupil and had evidently swallowed Indian methods *en bloc*. I had always thought that the disinfection of a large ship must be a troublesome business; I was wrong; in the hands of this expert the thing was simplicity itself. Walking along the deck he directed one of the brass plugs, through which the well is sounded, to be unscrewed, and then an assistant handed him a bottle containing about a litre of 1 in 500 hydrag. perchlor., which he forthwith poured down into the bowels of the ship. Heigh presto! down comes the yellow flag. Simple enough and expeditious enough, in all conscience. I should have been certain that he had studied sanitary science in India, even if he had not told me.

"My policy is the policy of the kettle and the cauldron: boil your water," said the late Mr. Ernest Hart. Apposite, no doubt, in his day and generation and largely applicable even now; but such a policy has two grave drawbacks in India, viz., first, that it is practical and therefore in sharp opposition to Eastern tradition, and secondly, it costs something. Spend money on hygiene? Well, do we not do so? Do we not have all our iron oval kettles tinned twice a month in order that the poor "bawarchee" may be spared unnecessary exertion in cleaning them and annex a little unearned increment in the way of backsheesh? Compare our solicitude in this respect with the apathy of the neighbouring Colony of Ceylon. Mark well the contrast. There, with a negligence that borders on the criminal, the unfortunate British soldier is callously,

left to risk the horrors of iron-poisoning, and deprived of all the well-known tonic effects of an admixture of lead in his dietary. Spend money? Yes! But we do more, far more, we appoint an *ipso facto* Senior Executive Medical Officer, and is he not worth untold gold, albeit none of it comes his way?

In the sultry land of Ind, e'en from Burma through to Sind,
Where the coccus and bacillus love to play :
There's a sanitarian who, without very much to do,
Pretends to work at hygiene, day by day.
It matters not a scrap, and no one cares a rap
That he's placed there mainly to deceive,
It's a little way we've got, in this Oriental spot,
And we call it, *ipso facto*, "make believe."

HINTS REGARDING THE MANAGEMENT AND USE OF X-RAY APPARATUS.¹

BY LIEUTENANT AND QUARTERMASTER F. BRUCE.

Royal Army Medical Corps.

(Continued from p. 171.)

HAVING in previous numbers explained the component parts comprising an X-ray apparatus, our next consideration is putting them together for actual work. In this procedure it is desirable to act by a preconceived method, and the following is suggested as a guide to the uninitiated. The coil is first prepared by placing the discharging rods in position with the points four inches apart, and if it is intended to use a mercury interrupter, the platinum points on the coil must be separated by a piece of cork or thick cardboard. Turn the handle of the commutator upwards, in which position no current can pass. Test the voltage of the batteries, and make all connections to interrupter and coil as shown in diagrams under the heading of Mercury Interrupters. Start the motor, afterwards switching the current on to coil by turning down the commutator handle. Observe the sparks passing between the points, and if the interrupter has been properly adjusted they should be rich and thick. For method of adjustment reference is invited to instructions for working Mercury Interrupters. At one of the points the colour of the discharge will be seen to be of a reddish hue, denoting the positive pole. Carefully note the position of this point as it is connected to the terminal on the anode end of tube. Being satisfied in all these particulars, switch off the current to the coil and stop the motor. Next place a tube in the holder with its axis parallel to the coil, and connect the terminal at the anode end of tube to that on the pillar of the coil carrying the point which showed the reddish discharge. The other terminal on tube and opposite pillar are similarly connected. The wires for making these connections must be well insulated, but need not exceed B.W.G. 25. About an inch of the insulation should first be removed from the ends of these wires and the metal scraped clean. The bare metal ends must be bent round in the form of hooks to make attachment

¹ This part of Lieutenant Bruce's paper ought to have preceded that published in the August number.—EDITOR.

with the terminals. It is usual to form these connecting wires into helices in order that they can be adapted for any change in position of the tube-holder. The tube, when in position, to be not less than three feet from the coil, as the intense magnetic field set up when the coil is in action might possibly damage it. The motor is now started, and having attained a medium speed, the current is switched on to the coil. Should all the connections have been properly made, half the tube in front of the anode will be seen to glow with an apple green colour, and on using a fluorescent screen, the bones of the hand, for instance, will appear quite distinct. If, however, the connections have been wrongly made, the appearance in the tube will be a series of ill-defined feathery-looking portions of blue light, with no effect on a fluorescent screen. Assuming that the reader has familiarised himself with the management of the tube, an easy subject such as the hand may be skiagraphed, but I propose to do so in a way to show the effects that can be obtained from different exposures.

In the dark room place the photographic plates into double light envelopes in the following manner, so that there can be no doubt regarding the position of the film side of the plate. As there are usually a dozen plates in each box as supplied by the dealers, have ready a like number of both yellow and black envelopes. Arrange these in two lots with the flaps uppermost, and place them side by side on a table in the dark room. Having closed the door of this room and turned on the red light, open the plate box and carefully remove one of the plates. Examine both sides, when it will be seen that one appears dull and lustreless, the other bright and sparkling, when held near the red lamp. The former is the film side, which is always placed next to the part to be skiagraphed. Take one of the yellow envelopes, and turning down the flap place the plate therein, film side uppermost. Turn the envelope over and insert it into a black one, so that the film side of the plate is under the plain side of the latter. The remaining plates having been disposed of in like manner, remove them to a place of safety which must not in any case be in the room where skiagraphs are taken.

To take the skiagraph, the envelope containing the plate is placed on a table at a point convenient to the possible adjustment of the tube-holder. Place the tube in the holder with its axis parallel to and distinct from the plate about twenty inches. The hand to be skiagraphed is placed on the envelope, and by the aid of a plumb line centre the anode over the middle of hand. Pro-

cure a piece of sheet lead at least the size of the plate, and place it over the hand in such a way that it completely covers the plate beneath. Now carefully slide the lead along the back of hand until a distance of two inches from the end of plate is left uncovered. Make an exposure of ten seconds, and taking care that the hand is not shifted from its original position, move the lead another two inches, leaving four inches of the plate uncovered and expose again for ten seconds. Taking the same precautions as before, move the lead still another two inches, and give a similar exposure. Remove the lead altogether and give a final exposure of ten seconds. The plate on development will show four distinct divisions corresponding to the different exposures received. Fig. 6 is a copy of a skiagraph taken under the conditions as described above. The division marked 4, which was last exposed, and only received ten seconds, is under-exposed, that is, thin and lacking in detail. Division 3 received twenty seconds, and although a little stronger than 4, does not equal 2 in fulness of detail, which received thirty seconds. In 1 there is evidence of over-exposure by the loss of contrast. Division 2 would therefore seem to have had the most correct exposure. The same procedure might be adopted with the forearm for a subject, for it is in experiments of this kind that practical experience can be acquired.

One of the primary objects we should aim at in taking skiagraphs is the endeavour to minimise distortion as much as possible, for it must never be forgotten that a skiagraph is simply a shadow of the subject impressed on the plate, and its dimensions are entirely dependent on the distance from the tube. From twenty to twenty-two inches from anode to plate will generally be found to give the best results. In addition, this distance will assist in protecting the patient from possible X-ray burns. Happily X-rays burning is not common, and cases which have occurred are, in my humble opinion, the result of two causes, viz., low tubes and too near proximity of tube to patient. I have skiagraphed over three thousand cases and none have suffered in even the slightest degree from X-ray burns, and I think I owe my success in this respect to the attention I always paid to the condition of tubes as well as distance from subject.

In estimating the necessary exposure for a given case there are certain factors that must be considered. The part to be skiagraphed may be either the hand or hip-joint as representing extreme conditions, and require totally different exposures. The condition of the tube is very important from the fact that the

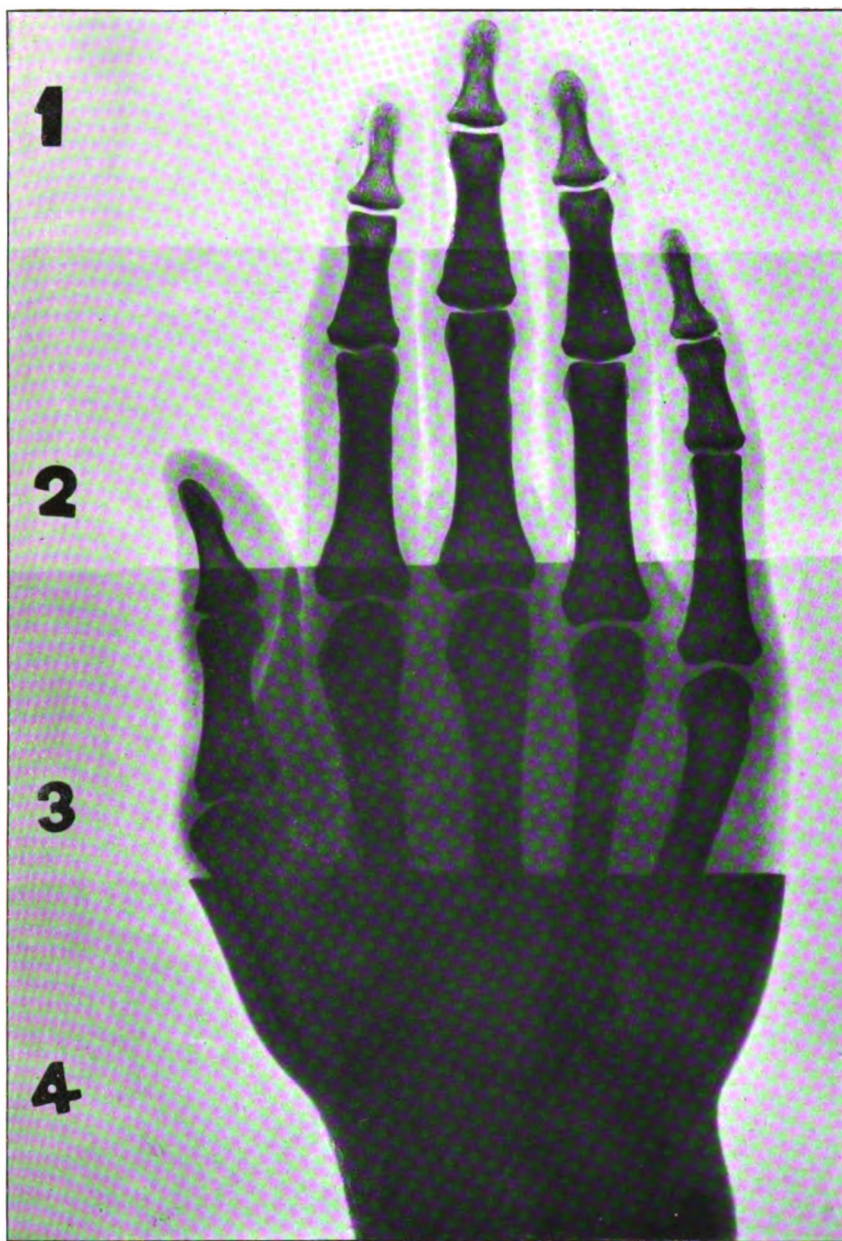


FIG. 6.

To illustrate article by Lieutenant and Quartermaster F. BRUCE, R.A.M.C.,
“Hints regarding the Management and Use of X-ray Apparatus.”

length of alternate spark gap determines the power of penetration ; in other words, the longer the spark gap the shorter the necessary exposure. To produce an image on a photographic plate it must be remembered that the silver salt contained in the film is capable of rendering visible the varying intensities of the light impinging on the plate, no matter whether it proceeds from the sun or an X-ray tube. From this it will be gathered that a very strong light would affect all the silver, producing a result void of all contrast or differentiation. In skiagraphing a thigh, for example, sufficient exposure should only be given to penetrate the soft tissues and at the same time to penetrate the bone to such a degree as to simply show its structure. When tubes of high penetration are used and unnecessarily long exposures given, hard and soft tissues are penetrated with equal facility, conditions fatal to the production of all contrast. It is therefore obvious that the matter of exposures requires careful consideration. In ordinary photography much assistance is afforded to the operator from exposure tables and light meters. Unfortunately the X-ray worker has no such helps at his command, as no hard-and-fast rule can be laid down for obvious reasons.

For the benefit of the beginner the following exposures are suggested, having given good results in my own experience. But they must be accepted as being approximate only, and should be varied to suit different subjects. The apparatus used was a ten-inch coil operated by a mercury jet interrupter with a primary circuit of 32 volts and 5 amperes. Average condition of tube about five inches alternative spark gap. Hand and foot, thirty seconds ; wrist and ankle, forty-five seconds ; forearm, elbow and lower part of arm, sixty seconds ; arm, leg, knee and head, seventy seconds ; shoulder and chest, ninety seconds ; hip-joint and pelvis, three minutes ; lumbar region and kidneys, two and a half minutes.

Whenever possible, injuries of the extremities should be skiagraphed in at least two different positions. In the case of fractures a truer estimate of the injury can be obtained from skiagraphs taken from different points than from a single view which only represents one plane. Where a Wheatstone's stereoscope is available the surgeon is provided with the means by which he can view injuries in relief. Unless this instrument is constructed with appliances for showing negatives as well as prints much time is wasted in preparing the latter, a serious consideration in dull weather. In using this instrument two skiagraphs are taken from two different points, usually a displacement of seven inches of the

tube. To put it more clearly, the second skiagraph is exposed after the tube has been displaced seven inches from the position in which the first was taken. In the absence of a special apparatus for holding the tube, the tube-holder on the Mackenzie-Davidson couch can be utilised, when the cross-bar will form an admirable guide for the travel or displacement of the tube.

Improved definition can be obtained by using a shield on the tube, when all extraneous rays which tend to fog the plate will be cut off. The rubber shield, as manufactured by Cox, answers this purpose admirably. In skiagraphing the kidneys or lumbar vertebræ the Thurston-Holland compressor diaphragm is of great assistance, and will, I am sure, in time form part of every important X-ray outfit.

[The matter of development formed the subject of the last paper, published by mistake in the August number.—EDITOR.]

(To be continued.)

ON THE TREATMENT OF ENTERIC FEVER WITH TYPHOID VACCINE.

BY LIEUTENANT-COLONEL C. BIRT.
Royal Army Medical Corps.

Contents.—*Fraenkel has injected beneath the skin of enteric patients, dead typhoid cultures.*

Therapeutic inoculations in Rabies, Tubercle, Plague, Micrococcus melitensis, Staphylococcus, Streptococcus, Gonococcus, Pneumococcus, Bacillus coli communis, and Proteus infections.

Daily injection of 10,000,000 dead typhoid bacilli into various parts of the subcutaneous tissue recommended.

In a long-forgotten paper which appeared in 1893, E. Fraenkel[1] reported the results of the treatment of fifty-seven cases of enteric fever with the subcutaneous inoculation of cultures of the typhoid bacillus which had been sterilised by heating to 63° C. The strength of the vaccine was such that when 3 cc. were introduced into the peritoneal sac of a guinea-pig weighing 350 grammes no serious symptoms ensued.

He began by administering $\frac{1}{2}$ cc. to his fever patient, followed by 1 cc. next day. Usually a fall in the temperature was noted after forty-eight hours, and a subsequent range at a lower level than before. If the curve afterwards tended upwards, another injection of 2 cc. was given. This was repeated two days later, should no response have been observed.

Fraenkel satisfied himself that good resulted from this method in the majority of instances, and that the fever was aborted in many. These are his words: "Man schneidet fast ausnahmslos die Fiebris continua ab, es kommt von anfang an zu einem ausgesprochen remittirenden charakter des Fiebers, und es erfolgt in unverhältnissmassig kurz zeit völlige apyrexia."

This contribution attracted little notice in the English medical press, probably because it seemed irrational to treat a fever in which the chief symptoms indicate a poison circulating in the system, with additional doses of the toxic agent. No doubt if we introduce the typhoid toxin directly into the veins the cumulative effect of the poison would be manifest. Fraenkel injected the dead bacteria into the subcutaneous tissues and gluteal muscles. This gives an explanation of an otherwise perplexing phenomenon.

Wassermann and Citron [2] have conducted some very important experiments on the local immunity of different parts of the body. They have proved that living tissues produce protective substances at the site of injection of bacteria. The cells in actual contact with the microbe are they which elaborate the defensive products. Thus they introduced typhoid emulsions into the pleural cavity of rabbits and found that the pleuritic exudation contained more bactericidal elements than the blood or fluids from other serous sacs. Again, they injected typhoid cultures beneath the skin of the ears of rabbits, and estimated from day to day the amount of protective bodies present in the blood. After a time they amputated the inoculated ear of one of the rabbits. A sudden fall in the quantity of anti-bacterial bodies in the blood was the consequence when compared with that of the blood of the other rabbits. This showed that the ear removed had been the nidus where the protective elements were being generated. In short, they found that the products evolved for the defence of the organism are always in greatest amount at the site of the inoculation. This, therefore, was the position: Fraenkel introduced the dead typhoid bacilli into a part where they were rapidly fixed by the tissues. The cells were excited into action and responded immediately by the elaboration of substances inimical to the bacteria. Not only did they produce them in such quantity as to deal effectively with the dose of toxin injected, but their activity did not cease and over-production resulted. This excess of immunising bodies was spent in combating the living bacteria causing the fever. Much evidence is forthcoming, and is accumulating daily, that this is a general principle. We will cite the following examples.

A huge experiment, altogether favourable, on the influence of inoculation during infection, has been going on since 1885. In that year Pasteur commenced his treatment of persons bitten by rabid animals, with emulsions of the spinal cords of rabbits, which had died of rabies artificially induced. Beginning with emulsions of a cord, the virus of which had become attenuated by drying, he injected into the flanks of the patients emulsions of cords of increasing virulence in rapid succession, until finally the victim of the bite received, subcutaneously, virus which, if injected into the anterior chamber of the eye, or beneath the dura-mater of a rabbit, would unfailingly cause rabies and death within ten days. The following figures prove how effective these anti-rabic inoculations have been: Since 1885, 108,000 [3] people have been subjected to this treatment. Their death-rate from hydrophobia has been about

0.5 per cent. The mortality from rabies of those bitten by mad animals who have received no anti-rabic inoculation, has been variously estimated from 16 to 80 per cent. If we take the lower figure it will be seen there has been a saving of nearly 17,000 lives through the genius of Pasteur.

This affords the most striking example of the efficacy of the injection of a virus in the course of an infection. It may be best explained by supposing a very rapid elaboration of protective substances in the area of injection of the cord emulsion. These bodies compass the destruction of the virus introduced by the rabid animal at the moment of the bite, which is slowly travelling along the nerves to the cerebro-spinal system.

Another great experiment on inoculation in the course of infection is the treatment of tubercular disease with the "new" tuberculin. Rather more than nine years ago Koch [4] brought out this remedy, denoted "T. R.," which is nothing more than an emulsion of washed dead tubercle bacilli. This has been extensively used. Reports on its beneficial action are numerous. Trudeau's [5] observations extend over a long period and deal with 1,367 tubercle cases treated hygienically, and 143 with the addition of tuberculin. He found that there were 20 per cent. more successes in the latter than in the former. He thinks that the administration of tuberculin as an adjunct to sanatorium treatment gives more recoveries and fewer relapses than sanatorium treatment alone, and seems to influence favourably the disappearance of tubercle bacilli from the sputum. Lawrason Brown [6] confirms Trudeau's statistics. Pottinger [7] has treated 589 cases with T. R., or allied substances. He claims that 84.2 per cent. were cured. Of 611 other tubercular patients there were 64 per cent. recoveries only. Healing was more rapid and relapses were less numerous under this specific medication. Denys [8] was successful in benefiting 71 per cent. of 442 patients by tuberculin injections. He holds that a cure may be looked for with confidence if the process has not gone beyond consolidation. His series includes invasions of the pleura, peritoneum, glands, bones, joints and intestines. J. Sawyer [9] has employed T. R. in 25 cases of early phthisis. He noted improvement in all, and is satisfied that it is a curative agent of value. O. Amrein [10] has given it to twenty-four patients with good effect. Kinney [11] has used this specific remedy for seven years, and concludes that there is no treatment comparable with it in effectiveness in uncomplicated tuberculosis. Max Elsaesser [12], from an experience of the administration of T. R. to seventy-six

phthisical patients, is convinced that under its influence appetite improves, bacilli and stethoscopic signs tend to disappear. Kraus [13] is also eulogistic. He has observed diminution of fever and pulmonary symptoms and amelioration in general under it. Lüdke [14] and Petrusky speak well of the use of tuberculin in various tuberculous conditions.

The employment of tuberculin as a curative agent has been put on a more exact basis by the illuminating researches of Sir A. E. Wright [15]. With his method of opsonic index determination it has become possible to measure the effect of the inoculation, to graduate the dose, and to fix the time of its administration. He has published noteworthy successes in the treatment of tubercle of the skin, glands, bladder, peritoneum, and bones. Bulloch [16], guided by the opsonic index, has announced remarkable instances of recovery or improvement under T. R. in cases which had long resisted other therapeutic measures. Lawson and Stewart, [17] with a large sanatorium experience, and after much painstaking work in making between 2,000 and 3,000 estimations of the opsonic index, conclude that in T. R. we have a valuable agent. With it the resistance and power of combating tubercle can be raised to a higher level than is often obtainable by hygienic treatment. Pardoe [18] is of opinion that in twenty-one cases of tubercle of the urinary system it was the best remedy at his disposal. Loveday [19], H. M. W. Gray [20], Whitfield [21], Emery [22], Ross [23], Butler Harris [24], Crace-Calvert [25], report numerous cases of tubercle treated with T. R. according to Wright's methods; they also testify to its value.

Inoculations against plague of sterilised cultures of *Bacillus pestis* have been carried out in India on a very large scale, and it must necessarily have happened that some of the subjects were already infected when vaccinated. Bannerman [26] has collected 225 such instances. Their death-rate from plague was 50 per cent., against a mortality of 74 per cent. among the uninoculated. R. W. Hornabrook [27] has recorded a mortality of 39 per cent. in eleven plague patients inoculated with anti-plague vaccine during the infection. That of the unvaccinated was 77 per cent. Alice Corthorn [28] mentions four recoveries of plague-stricken people whom she had inoculated after they had contracted the disease.

For Malta fever, which has been hitherto a reproach to therapeutics, a hopeful remedy appears to have been discovered in sterilised cultures of the *Micrococcus melitensis*. S. T. Reid [29] has reported nine recoveries accelerated through injections of the

emulsion, the doses of which were regulated by the opsonic index of the patient. A case in the eighteenth month of disease, under treatment at the Queen Alexandra Hospital, is now receiving these inoculations, with the result that his opsonic index is raised and improvement has begun.

Staphylococcic diseases, such as chronic furunculosis, sycosis, acne, have been greatly benefited by inoculation with staphylococcic vaccine. Wright [30] has recorded thirty successful cases. Stopford Taylor [31], Weinstein [32], and Gray [33] have similarly announced good results. Kenneth W. Goadby [34] has treated eleven cases of long-standing alveolar suppuration, some of which had been undergoing other therapeutic measures for years without avail, with sterilised emulsions of staphylococci. He attained a marked degree of success.

In the more formidable streptococcic invasions, such as malignant endocarditis, cases which have resisted repeated doses of anti-streptococcic serum have yielded to inoculations of sterilised emulsions of the *Streptococcus* isolated from the patient's blood. Barr [35] records an example.

Coleman [36] relates how he successfully treated a case of lobar pneumonia by injecting beneath the skin sterilised cultures of Fraenkel's pneumococcus. Ross [37] also, has cut short a pneumococcic empyema by the same means.

The sequelæ of gonorrhœa have been abated by raising the opsonic power of the blood against the gonococcus by means of subcutaneously administered sterilised emulsions of the gonococcus.

Wright [38] has published cases of invasions of the gall-bladder, ducts, and urinary bladder by the *B. coli communis*, which had proved intractable to treatment, benefiting greatly by inoculations of sterilised emulsions of the bacillus isolated from the bile or urine in question.

Proteus infection of the bladder has improved under the administration of proteus vaccine. Wright reports an instance.

Löwenstein [39] proposes to treat lepers with heated emulsions of leprous nodules. The same author suggests that sufferers from trachoma should be inoculated with sterilised suspensions of the contents of the granules of the affected eyelids.

It is therefore abundantly evident that subcutaneous injections of the appropriate vaccine in the course of an infection have a therapeutic value. The invading parasite does not harm all the tissues of the body in the same degree. For instance, the virus of

hydrophobia introduced by the bite of the rabid animal manifests a preference for the peripheral nerves along which it travels to the central nervous system. We therefore requisition the services of the cells least influenced by the microbe and by stimulating them to activity with the specific vaccine we cause them to elaborate substances antagonistic to the parasitic foe. The sufferer then manufactures his own anti-bodies instead of our endeavouring to provide them for him ready made in the form of serum derived from an immunised horse—an attempt which too often ends in failure. This production may begin early and proceed quickly. In anti-rabic inoculation protective elements must be evolved with great rapidity. On the sixth day of Pasteur's intensive method, an emulsion of so highly a virulent cord is injected that it would of itself induce rabies in the individual if immunity had not been established by the inoculations on the five preceding days. Wassermann and Citron sometimes observed that substances inimical to the bacteria were present at the site of the inoculation in twenty-four hours. Wright and others have noted a rise in the opsonic index often on the day following the administration of the vaccine. It therefore seems reasonable that therapeutic inoculations should be commenced early and continued daily. But the dose must be small. The infected organism reacts more markedly than the healthy body. The tuberculin and mallein methods of diagnosis of tubercle and glanders in animals are based on this sensitiveness. Wright has reduced his doses of T. R. from the $\frac{1}{800}$ mgr. originally recommended by Koch, to $\frac{1}{2400}$ mgr. in some cases. All observers are unanimous in emphasising the necessity of the use of extremely small quantities of this agent. W. S. Harrison [40] states that 1 cc. of the anti-typhoid vaccine prepared at the Royal Army Medical College contains 500,000,000 bacteria. This is the dose authorised for the first preventive vaccination. The reaction which arises therefrom is not severe. All symptoms have disappeared as a rule in thirty hours. It is suggested that $\frac{1}{80}$ cc., or 10,000,000 typhoid bacilli, should be the dose employed for therapeutic inoculation. Leishman [41] has shown that 17,000,000 bacteria cause no appreciable reaction in healthy men. Our aim should be to gauge the amount so as to produce as few constitutional and local symptoms as possible in the fever patient. Where laboratory facilities exist the blood changes which arise after inoculations should be studied by means of opsonic index determination, or by Bordet and Gengou's [42] reaction of fixation of the complement. But if only we are careful to keep the daily dose below the limit at which a reaction

begins to appear, no evil will result from a lack of knowledge of the actual blood condition. The site of the injections should vary; no part should be twice inoculated. The cells, after much stimulation, lose their activity and cease to elaborate elements hostile to the excitant. Thus the mucous membrane of the large intestine is uninfluenced by the *B. coli communis*, while that of the bladder reacts vigorously; cystitis is the consequence, and blood examination shows that specific products are being generated. Then, too, after recovery from enteric fever the typhoid bacillus may become a permanent inhabitant, harmless to its host, of the gall-bladder or alimentary canal and ceases to manufacture anti-enteric substances.

South Africa and Bermuda appear to be the commands in which therapeutic inoculation might be tested with greatest advantage. In the large majority of instances, febrile attacks occurring there among the troops during the enteric season are enteric fever, though many are abortive and are apt to be diagnosed "simple continued fever," "influenza," "bronchitis," "tonsillitis," "diarrhoea," "rheumatism," &c. If, as is suggested, every pyrexial case immediately on admission were treated with daily subcutaneous injections of $\frac{1}{10}$ of the ordinary preventive dose of anti-typhoid vaccine (easily measured by diluting 1 cc. with 49 cc. of sterile water) the upshot would be—should there be virtue in the remedy—that the number of aborted attacks would be augmented. If care were not taken, it might then happen that the official returns would show no reduction in the case-mortality of enteric fever; but only an increase in the admission rate for "bronchial catarrh," &c., &c. An exact diagnosis by means of cultures from the blood of the patient is therefore much to be desired. As, however, there is considerable reluctance on the part of the physician to draw off 5 or 10 cc. of blood from a person suffering from an apparently trivial ailment Conradi's [43] bile method might be employed, which requires so small a quantity of blood that it may be readily withdrawn from the finger tip. Widal's reaction in most instances is ruled out of court. On the one hand, in the early stages of the fever and in mild attacks, the serum, in dilutions above the limit of error, does not clump the enteric bacillus. On the other hand, the inoculations themselves cause agglutinins to appear in the course of a few days.

Early treatment is insisted upon before gross lesions, such as deep ulceration of the bowel, or profound toxæmia, with the concomitant engorgement of the lungs, have set in.

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Clinical and other Notes.

ENTERIC FEVER IN NATIVES OF INDIA.

BY MAJOR W. T. MOULD.
Royal Army Medical Corps.

THE prevention of this disease is an ever-present problem to the Army Medical Officer, and having had no less than fourteen cases in the small garrison here (Fatehgarh) in the past year, it has always been in my mind. The difficulty of tracing the source of infection is always very great, and in the majority of cases one is at a loss to give a satisfactory explanation for single cases, although when there is a distinct outbreak one can generally find enough to account for it. One thing often overlooked is its occurrence amongst the natives who surround us, and I think my experience in that respect is worth recording.

In 1903 there were no cases amongst the troops, so on the admission of a case in January, 1904, having found out that no convalescent had recently arrived at the station, I knew that the man must have become infected from native sources, and on mentioning it to the Civil Surgeon he told me that he had a case in hospital in the person of a police sepoy, showing it was then present in the neighbourhood.

Later in the year I saw four cases in natives; this is rather an unusual experience, and I think as these cases were seen it points to the disease being widespread, especially if one considers how few cases of "bukhar" really come under the care of medical officers, and having regard to the habits of natives as regards their evacuations, it is easy to understand the British soldier becoming infected notwithstanding all the care devoted to the sanitation of his barracks and their surroundings. This especially so in the early part of the hot weather, when clouds of dust penetrating everywhere are the rule. And I think that until we know more of the incidence of this disease amongst the natives little more can be done to protect the soldier. Now he is well housed, well fed, his water-supply carefully looked after, and in many places boiled, and so carefully stored as to be above suspicion, as is the case in this station, and everything done to keep him safe. Yet, as we know, enteric fever is as great a scourge as ever.

A short account of my cases may be of interest, and I have no doubt as to the correctness of the diagnosis in any of them, and Cases 2 and 4 were confirmed by a positive result on the blood being examined by a Vidal's test.

CASE 1.—In May one of the men, Army Hospital Corps, asked me to see his daughter as she had had "fever" for about ten days, and the

medicine the Hospital Assistant was giving her was not doing her any good. I found a girl, aged 13, with all the clinical symptoms of enteric fever, who had been treated with quinine for a week; the temperature had not been recorded but was reported as continuous, slight diarrhoea, a tongue red at the edges and furred at the centre, the abdomen distended and tender over the right iliac fossa. I ordered all the necessary precautions to be taken, a milk diet given, and small doses of a diaphoretic mixture. The temperature fell gradually and she made a good recovery.

CASE 2.—Mahagoo, aged 22, a "sais" of the Mounted Infantry School, came sick on June 28th, saying he had had fever for two days, and was admitted. He had nothing noticeable about him except that he was much more ill than the degree of temperature accounted for, and I thought nothing more than malaria fever (which was then prevalent) was the matter with him. On July 2nd, at my visit, his temperature was 103° F., tongue was coated with a white fur, the tip and edges being red, the abdomen was somewhat distended, but there had been no diarrhoea. Remembering the former case I ordered him to be treated as a suspicious case and all the usual precautions taken. Two days after I saw a stool, which was characteristic, and the other symptoms being more marked the diagnosis was certain. I sent a specimen of his blood to the District Laboratory at Lucknow on the eleventh day and the diagnosis was verified by a positive Widal's reaction. The patient had a mild attack and recovered without any complications.

CASE 3.—In July, when inspecting the Regimental Bazaar, a "bunnia" asked me to see his son. He was a boy aged 14, and was reported to have had fever for about a month, and his leg had just swelled. He had been treated by two "hakims." I saw the boy and found him much pulled down; he had been ill for a month. I was told the fever had been continuous with delirium; diarrhoea had been very bad, and his father had not thought he would recover, but the fever had gone off, and as he had begun to improve pain and swelling of the thigh had come on. The right femoral vein was thrombosed, but except for that when I saw him he was convalescent. I tried to get a specimen of his blood for examination but could not persuade either the boy or his father to let me take it, so my diagnosis is not verified, but no medical man seeing the case would have made any other. I arranged that a hospital assistant should treat him, and kept him under observation myself. I also ordered the disinfection of stools and urine, supplying the material, and hope it was done. All clothes, &c., were boiled, I know. Recovery was good.

CASE 4.—In August, while acting as Civil Surgeon, I saw another case, Zaman Khan, aged 23, a police sepoy. He was admitted to the Police Hospital on the 24th in an ague fit, and this recurred on the 27th. On my bi-weekly visit on the 30th the temperature was 102° F., and the Assistant Surgeon drew my attention to the case and suggested it was enteric fever, as he had seen some cases in another district. I examined

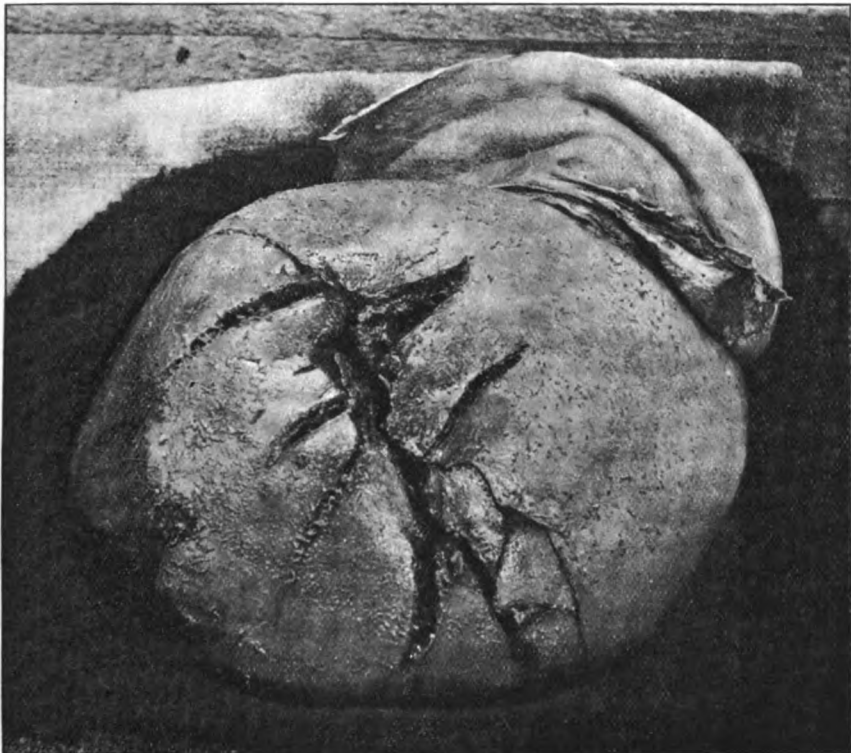
the man and thought him a suspicious case and gave directions for his treatment. I saw him again on September 1st and the case was clear. On the 4th some blood was sent to the Pasteur Institute at Kasauli, and the Director reported a positive result with Widal. I have no notes of the case except those made on the temperature chart, but he had a severe uncomplicated attack and made a good recovery.

RUPTURE OF LIVER DUE TO A FALL.

By CAPTAIN H. HERRICK.
Royal Army Medical Corps.

THE following case has come under notice at Sierra Leone, and as it is extremely rare I am sending the following notes for publication.

When paying my evening visit to hospital on January 1st, 1906, I was informed that a man of the 1st West India Regiment had fallen down and



injured himself, and that a stretcher had been sent out in charge of an orderly to bring him to the Military Hospital, Tower Hill. In about a quarter of an hour the party returned with the dead body of the man.

It appears he was walking down from Mount Aureol Barracks to Free-town, and must have missed his way (being new to the place), and in coming down a narrow path he slipped and fell a distance of about ten feet into a shallow stream, his right side coming in contact with a flat stone in the centre of the brook.

The man was under the influence of drink at the time. I examined the body at once and the only external marks were two small bruises over the region of the liver. At 7 a.m. the next morning (January 2nd) I made a *post-mortem* examination. On opening the abdomen a quantity of clear serum escaped followed by blood-stained fluid; the intestines were covered with thick blood-stained lymph, and the stomach was distended with fluid which smelt strongly of alcohol.

On removing the liver an enormous rupture was found (about 8 inches in length, almost through the right lobe, with several small fissures branching off from the main rupture). The liver was not enlarged, did not feel soft, and weighed 56 ounces.

The accompanying photograph will show the extent of the lesion better than any description. All the other abdominal organs were healthy, and there were no fractured ribs. The brain was healthy with the exception of slight congestion of superficial blood-vessels. There was no fracture of any of the cranial or spinal bones.

REPORT ON FIVE CASES OF BILHARZIA.

By LIEUTENANT-COLONEL D. WARDROP.

Royal Army Medical Corps.

FIVE cases of bilharzia have recently come under my notice which call for comment.

CASE 1.—Private Raybould, 2nd South Staffordshire Regiment, proceeded to South Africa in November, 1902, and remained there until May, 1903, when he returned to England. In November, 1904, he went to India. Up to this time he had enjoyed good health and is positive that he never had any hæmaturia or urinary trouble of any sort. In September, 1905, while serving in Allahabad, he went sick with symptoms of bilharzia, and eggs were found.

CASE 2.—Private Pedley, 2nd South Staffordshire Regiment, was in South Africa from August, 1901, to February, 1903, when he proceeded to India and was quartered at Allahabad. He had good health and had no sign of urinary trouble until October, 1905, when he began to have pain on micturition and passed blood. He was found to be the subject of bilharzia.

It will be seen that both these cases were in men of the same regiment. Both had been in South Africa, but both had left it for considerable periods—about two years and a half—before the symptoms of

bilharzia showed themselves. On questioning the men the fact was elicited that another man in the regiment was the subject of this disease but had been discharged from hospital cured.

CASE 3.—Private Allatt, 2nd Yorkshire Regiment, was in South Africa for two years and a half and had very good health all the time. Left the country in November, 1902, for India. He had no urinary trouble up to the summer of 1904, when hæmaturia and penile pain commenced and have continued ever since.

CASE 4.—Private Bottomley, West Yorkshire Regiment, contracted bilharzia in February, 1906, after a six months residence at Mian Mir. He had never been out of England before he proceeded to India.

CASE 5.—Private Mitchell, Argyll and Sutherland Highlanders, had never been abroad until he went to Poona. After being stationed there for six months he proceeded with his regiment for manœuvres to Secunderabad, and after having been there about ten days he developed bilharzia, the infecting locality being, in all probability, Poona.

These five cases, when they came under my notice, had all marked symptoms of bilharzia, and eggs were found in each.

The interesting fact in connection with the series is the source of origin of the attacks. The two last cases were undoubtedly infected in India, the actual localities being Mian Mir and Poona. As regards the other three, a more than strong presumption exists that they were also contracted in that country. The period of incubation could not possibly extend to the long time which elapsed between the men's departure from South Africa and the onset of the disease, and the theory that the *Bilharzia hæmatobia*, in some portion of its unknown life, may have remained in their clothing, seems too improbable for credence. If we exclude it the fact must be accepted that all five cases were contracted in India.

A CASE OF RUPTURE OF SACCULAR ANEURYSM OF THE FIRST PART OF THE AORTA.

BY CAPTAIN N. J. C. RUTHERFORD.
Royal Army Medical Corps.

COLOUR-SERGEANT X., 1st Battalion Grenadier Guards, age 32, service fourteen years, was admitted to the Queen Alexandra Military Hospital about 3 p.m., on February 3rd, 1906.

History as follows: was quite well that morning; came up from Aldershot with two comrades to see a football match. He appeared all right in the train until half the journey was over, when he told his friends he was feeling sleepy and settled back into the corner of the carriage as if to have a nap. Before the train arrived, it was noticed that Colour-Sergeant X. was in a strange condition, his head rolling about and his

body swaying; no explanation as to what was the matter could be got from him. On arrival of the train, his alarmed comrades put him in a cab and drove to the hospital.

No history of any injury or "ragging" in the carriage, likely to produce an injury, could be obtained. Patient was put to bed and examined. He was in a semi-unconscious state, could be roused to say "yes" and "no," but no information was deducible from his mono-syllabic answers. There was marked collapse, the skin surfaces were cold, the pulse could be counted with difficulty (about 130) and the temperature was sub-normal. He complained of thirst, and had been given a little brandy and water, which he vomited. The bowels were opened once after admission.

There was no scalp wound, or ecchymosis, the pupils were equal, not dilated, and reacted to light, neither was there any twitching of muscles or paralysis. The cardiac sounds were rather indistinct; there was no murmur. The cardiac dulness thought to be increased to the right of the sternum. The lungs were normal and movement of abdomen not restricted. On palpation tenderness over hypogastrium was complained of, but on continued palpation, and endeavouring to elicit answers from the patient, it was evident that pain or tenderness was not present. It was thought the percussion note in both flanks was duller than normal, but there was so little resonance, excepting a tympanitic note over stomach, that this condition did not help the diagnosis much. There was no distension and no rigidity. The bladder was not distended. There was no distinctive odour from the breath, and no marked restlessness. The deep reflexes acted sluggishly; there was no muscular rigidity or loss of power. The patient was able to raise his limbs from the bed when asked to do so.

Treatment to reduce shock and collapse produced an improvement in colour and surface temperature; the mental condition and the pulse did not improve. There was no rise in temperature, nor did the patient pass into a state of coma.

The case was watched for the next few hours, no change taking place, patient lay on his side with a tendency to curl up in his bed; he was drowsy, lethargic, had a weak pulse, and the temperature remained subnormal. A catheter was passed and three ounces of urine drawn off for examination; almost immediately a clonic convulsion seized him, lasting about thirty seconds, and leaving him comatose with long gasping respirations; a slighter attack followed in five minutes. As the man appeared to be dying, oxygen was administered and I opened the right median basilic vein and transfused three pints of normal saline. The patient seemed to rally completely, the pulse returned, respiration became normal, and he came out of the coma. Within twenty minutes of the apparent recovery another convulsion occurred and he died a few minutes afterwards.

Lieutenant-Colonel C. Birt, R.A.M.C., has been kind enough to allow me to attach the *post-mortem* report.

Post-mortem.—The body was that of a man looking older than his assigned age, in good physical condition. Rigor mortis present, lividity about back and neck, no marks of injury on any part of the body, surgical opening into the right median basilic vein, no scars, no signs of syphilis, on percussion the cardiac dullness was increased by a rib's breadth. The *lungs* were resonant in front, but there was a flatter note on left side behind than on right.

Head.—No ecchymosis or otorrhœa, calvarium normal, no fracture, membranes healthy, no blood in subarachnoid space, pia mater congested, vessels of base normal, brain healthy except a few punctate hæmorrhagic spots in the right hemisphere and general venous congestion, no focus of softening.

Thorax.—Before opening the thorax, the precordial dullness was found extended, suggesting fluid in the pericardial sac. About half a pint of blood in the left pleural cavity, the right pleural cavity was normal, the pericardium was full of blood which had escaped from a small rent in an aneurysm of the first part of the arch of the aorta, no pericarditis.

Heart.—Twelve and three quarter ounces, was somewhat hypertrophied, right auricle and ventricle normal, pulmonary and tricuspid valves healthy, left auricle normal, mitral valve not dilated nor diseased in any way, aortic valves normal though orifice was dilated, immediately above the opening were thick cartilaginous-like patches of atheroma, the sinuses of valsalva were all distended, the right had become dilated into an aneurysm the size of a walnut which had ruptured by a rent about 2 mm. wide into the pericardium, there was no atheroma elsewhere in the aorta or great vessels, nor other aneurysm.

Lungs were normal.

Abdomen.—Much subcutaneous fat, no effusion into peritoneal cavity, intestines collapsed, healthy.

Liver.—Increased in size with some increase of connective tissue.

Right Kidney.—Nine and three quarter ounces. *Left*, seven and three quarter ounces. Capsules stripped readily, in places the cortex was rather thin, in others increased in depth, somewhat fatty, resembled what are found in large beer drinkers.

Cause of Death.—Rupture of saccular aneurysm of first part of aorta.

Travel.

A HOLIDAY TRIP IN ALGERIA.

By MAJOR F. W. BEGBIE.

Royal Army Medical Corps.

To those who are anxious to avoid the biting east wind, the cold and rain of the month of March in England, I can, with confidence, recommend a tour in Algeria.

Algiers, the capital of Algeria, is within fifty-four hours' journey from London. Leaving Victoria at 11 a.m., Paris was reached at 6 p.m. Driving from the Gare du Nord to the Gare du Lyons we were able to enjoy dinner at the excellent refreshment rooms in the station before entraining for Marseilles at 9 p.m. It is advisable, especially at this time of the year, to book seats on the train in advance, on account of the numerous passengers proceeding to the south of France. A very comfortable journey in a well warmed train, landed us in Marseilles about 9 a.m. on the following morning. The steamers of the *Campagne Transatlantique* leave Marseilles every Monday, Wednesday, Thursday and Saturday at 1 p.m., arriving in Algiers about 4 p.m. the next afternoon. Much cannot be said for these steamers; they are small and evil-smelling and the food very inferior; but, at the same time, they are excellent sea-boats. The approach to Algiers from the sea afforded us one of the best views of the town we were able to obtain. Facing the Boulevard de la République is a magnificent harbour, well sheltered, and able to contain the whole of the French Mediterranean Fleet; and here we dropped our anchor. Hardly had the engines ceased before the decks of our steamer were swarming with Arabs, all desirous to possess themselves of a portion of our baggage. Having fixed upon our porters we followed them to the Custom House on the quay, where we found there was little trouble in clearing our belongings; the importation of gunpowder and cartridges is, however, strictly forbidden. A three miles' drive lay before us to Mustapha Supérieur, which is situated on a wooded eminence overlooking the town, and on which are to be found most of the best hotels. There is not much to choose between the Hotel St. George, the Hotel Kirsch, and the Mustapha Palace Hotel; they are all good, and the charges are 12½ francs a day.

Algiers has been a French possession since 1830. In that year

the French broke the power of the Dey, and abolished slavery throughout Algeria. The most formidable antagonist of the French generals was the famous Abd-el-Kadir, who inflicted very severe losses upon the French arms, and who was not finally routed until 1847. On the outbreak of the Franco-German War, in 1870, the French troops were withdrawn from Algeria; a general insurrection followed, which spread so rapidly that it became necessary to re-conquer almost the whole country. Since then, with occasional outbreaks, peace and prosperity have reigned through the province.

The population of Algeria consists of French, Spaniards, Italians, Maltese, Arabs, Moors and negroes. Of the European population, a large number are Jews, who first settled in the country in the fourteenth century, on being driven out of Italy, Spain and Portugal.



FIG. 1.—The Jewish Quarter, Algiers.

The French Government maintains a large standing army in Algeria, comprising some 60,000 men, and commanded by a General-in-Chief, with a residence in Algiers. The troops themselves are composed of Zouaves, Tirailleurs, Chasseurs d'Afrique, Spahis, Artillery, Engineers, and the Foreign Legion, the latter recruited mostly from deserters from foreign armies.

Every year Algeria is becoming more popular as a health and pleasure resort during the winter months. Of these months November and December are very enjoyable. January and February are

generally wet and cold, while March, April and May, resemble an English summer. During our trip we met several invalids, who declared they had derived more benefit from their stay in Algeria than they had previously done from wintering in the Riviera.

There are practically no endemic fevers in Algeria, due largely to the extensive planting of the *Eucalyptus globulus* throughout the province. The country through which we travelled has been laid by the French under a very rich cultivation. Vineyards abound in all directions, producing an excellent wine, the export of which to France is valued at two million francs per annum. Fruit of all kinds is grown in the country, and further south, on the edge of the Sahara, date palms are to be seen everywhere.



FIG. 2.—View of Algiers from the Citadel (with Notre Dame d'Afrique in the distance).

The town of Algiers is divided into three distinct quarters: the old Moorish town, the Jewish quarter (fig. 1), and the modern French quarter. It is this mixture of the Eastern and Western world, combined with the exquisite scenery throughout the province, which renders a holiday tour in Algeria so delightful. The streets and the native shops in the old quarter of the town are full of quaint charm, and afford the photographer many opportunities for taking unique snapshots. In some parts of the Moorish town one could easily imagine oneself in Cairo or Damascus, so eastern are the surroundings; and yet within a few hundred yards of the "Casbah" one finds oneself in the centre of a modern Paris. The summit of the Moorish town is crowned by the Citadel, or "Cas-

bah," formerly the palace of the Dey, from which can be obtained a magnificent view of the French town, the harbour, and the bay (fig. 2). There are numerous mosques in the French quarter well worthy of a visit; while situated on a hill to the west of the town, overlooking the sea, is the famous cathedral of Notre Dame d'Afrique, where every Sunday afternoon the officiating clergy hold a service in the open air for the souls of those sailors who have perished at sea.

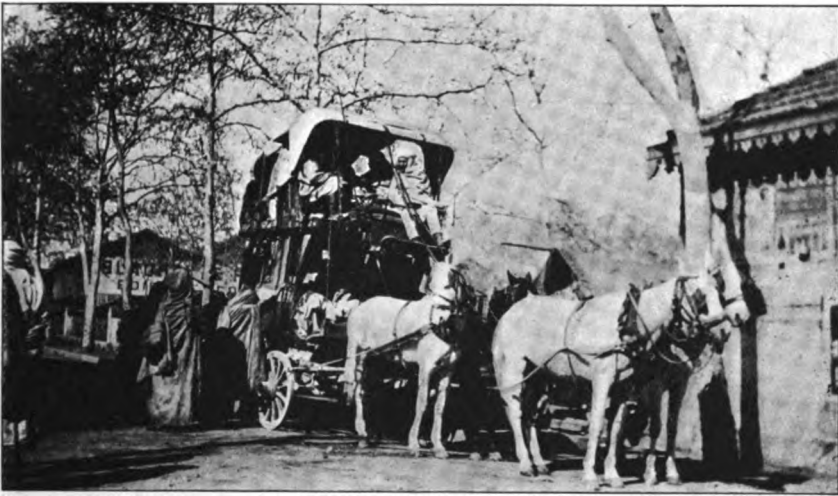


FIG. 3.—Arab diligence starting off from Maison Carrée, near Algiers.

Of the many excursions to be made in the neighbourhood of Algiers one cannot speak too highly. Every hill-top discloses fresh valleys, rich with cultivation, to which the azure blue of the Mediterranean makes a fitting background. One of the best excursions is to Blidah, fifty-one kilometres from Algiers, where can be seen one of the finest breeding establishments of Arab horses in Algeria. A visit should also be paid to Maison Carrée (fig. 3), where a market is held once weekly, and to which flock Arabs, Moors, and Kabyles from the mountains with their cattle and horses to attend the fair. We were much amused, while wandering round, to find a voluble French quack extracting the molars of the Arabs, under a palm tree, to the running accompaniment of the beauties of his patent "pain killer." Having spent a week sight-seeing in Algiers and the vicinity, we started for Bougie, *en route* for Biskra. The

one great drawback to travelling in Algeria is the very early hour at which the trains start. We were called at 4 a.m., and were off before 6 a.m. We changed carriages at Beni Mansour and reached Bougie the same afternoon. Bougie is the chief port of eastern Kabylia, and is situated at the foot of the Gouraya Mountains, surrounded by clusters of orange, pomegranate and fig trees. We remained for the night at the Hotel de France, and were well looked after by a waiter who four years previously had been at the Hotel Cecil. An early start was made next morning by a three-horsed carriage for Kerrata, in the heart of the Kabyle Mountains, our road lying through the famous Gorge de Chabet, an enormous defile five miles in length and some 1,200 feet above the torrent. This road was cut by the French sappers in 1870, and forms a splendid



FIG. 4.—Caravan on the march in the Sahara.

testimonial to their genius. We remained the following day at the Hotel de Chabet, Kerrata, exchanging the genial warmth of the plains for the icy cold of the mountains, on which the snow was still lying. An early start was again made the following morning, and descending the mountains on the opposite side of the pass, into the fertile valleys of the plains, we reached Sétif, on the railway, in time to catch the train for El Guerrah, where we passed the night. At 9 a.m. we entrained to complete our journey to Biskra. We travelled through country rich in growing crops and fruit trees, until mid-day, when the landscape began to change and to become more rocky and barren. About 4 p.m. we passed through the rugged gorge of El Kantara and emerged into the boundless Sahara Desert. As far as the eye could reach there was nothing to be seen except sand and stones, dotted here and there with groves of palm trees,

marking the different oases, in one of which was our objective, Biskra, "the Queen of the Sahara" (fig. 4).

The town of Biskra is rapidly becoming a famous health resort, the air being dry and fresh off the desert, and the temperature in the shade between November and April only 60° F. During the winter months the rainfall rarely exceeds eighteen to twenty days in all, so there is little to prevent invalids from enjoying the open air to their heart's content.

There are several good hotels in Biskra, but the best is The Royal (fig. 5), famed for the view, which can be obtained from



FIG. 5.—Royal Hotel, Biskra.

the flat roof, of the desert sunset. Biskra is typically eastern, with a large native quarter and a straggling French town. The native market, the bazaars, the Château Landon, old Biskra, the negro village, and the Rue des Ouled Naïls are all well worthy of a visit, and some excellent photographs can be obtained. The Dance de Ventre, by the Ouled-Naïl dancing girls, should not be missed, as exemplifying what extraordinary contortions the human figure can be made to perform. Horses and camels can be hired for the journey across the Sahara to the sand dunes of Dumach, the oasis of Chetma, and the typically eastern village of Sidi-Okba (fig. 6). This village contains the oldest mosque in Africa, and shelters the shrine of the warrior Sidi-Okba, who conquered Africa from Egypt to Tangiers, in 680 A.D. Close to Biskra, on the eastern side, are the sulphur baths of Hammam-

es-Salahin, much esteemed by the Arabs (fig. 7), who believe that they will cure everything. Leaving Biskra in the small and early hours our train reached Batua in time for lunch. Here we found



FIG. 6.—The Market, Sidi-Okba.



FIG. 7.—Hammam-es-Salahin (Fontaine Chaude, or hot sulphur baths), near Biskra.

a carriage waiting for us and started for a drive of thirty miles to Timgad, passing on the way Lambèse, the ancient Lambœsis, built by the Romans in A.D. 125, to form the headquarters of the Third

Augustan Legion. The ruins of Lambèse are still in an excellent state of preservation, and we were able to examine at our leisure the remains of the Prætorium (fig. 8), temples of Jupiter and



FIG. 8.—The Prætorium, Lambèse.

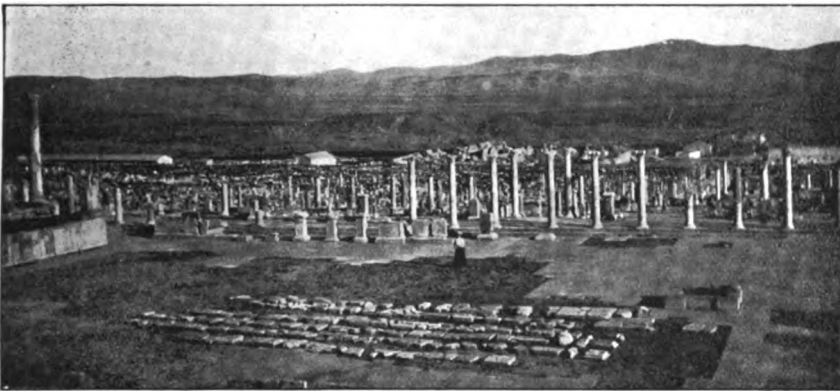


FIG. 9.—View of the Ruins, Timgad.

Æsculapius. In the cool of the evening we finished our journey to Timgad, but left the examination of the ruins until the following day.

The ruins of Timgad are in an almost perfect condition, and

each year fresh marvels are unearthed, owing to the energetic manner in which the old Roman city is being brought to light by the present French Government. The old city is divided into two parts by a broad paved road, the *Cardo Maximus*, on the large flagged stones of which are to be seen the marks of the chariot wheels of old. The Forum (fig. 9) is now entirely unearthed, and an idea of its size, as well as of the general excavations, can be seen in the accompanying photograph. The *Thermæ*, or hot baths, with a still readable inscription, dating from the reign of Septimus Severus, in 179 A.D., are wonderfully preserved. No one visiting Algeria should neglect to visit Lambèse and Timgad; in my mind,



FIG. 10.—Changing the Turco Guard, Constantine.

even more worthy of a visit than Pompeii itself. There is a good, but somewhat small and primitive, hotel at the ruins where accommodation can be obtained. Leaving Timgad, we returned by carriage to Batua, and thence the same day trained to Constantine, arriving in time for dinner.

Constantine (fig. 10), situated some 600 feet above sea level, in a gorge in the hills, is a fortress of the first order. It is reported to have withstood in the early days eighty sieges, and to have been finally taken by the Romans in the reign of the Emperor Constantine, from whom it derived its present title. In 1535, Constantine became part of Algeria under the Turks, and later, in 1837, fell into the hands of the French, who now quarter 3,000 troops in the town.

The Palace of the Bey, El Hadj-Ahmed, is well worthy of a visit, if only to study the well-preserved and ancient painted tile-work. The Palace is now used as the official residence of the General Officer Commanding. The views of the surrounding country to be obtained from various parts of the town are beautiful in the extreme; while a walk through the Gorge des Tourists should not be missed. The Hotels in Constantine, however, leave much to be desired. Before quitting this province the baths of Hammam-Meskoutine should be visited. They are of the greatest antiquity, and were largely used by the Romans. In 1837 the French sent chemists and medical men to report on the hot springs, and so satisfactory was the result of their investigations that a large thermal establishment grew up there. The hotel and baths are situated on a beautiful plateau, 960 feet above the valley, in a garden overflowing with flowers and fruit, amongst which strawberries, gooseberries, lemons and peaches abound. Wild boar, hare and partridge shooting can be had in the vicinity. The waters themselves are strongly impregnated with carbonate of lime, magnesia, strontium and iron, with a mixture of sulphate of soda, and are largely sought after by those suffering from rheumatism and skin diseases. On leaving Hammam-Meskoutine two routes can be taken: one towards Tunis, to view the ruins of ancient Carthage, and thence by steamer either to Palermo or Marseilles; the other directly back by train, taking from 6 a.m. to 8 p.m., to Algiers. We chose the latter in order to visit the mountain regions of Kabylia. There is an old Kabyle proverb which says: "He who has not seen Kabylia has not seen Algeria," and this is in a large measure true. The beautiful mountain scenery can best be compared to that which surrounds many of our Indian hill stations, and the Kabyles themselves very closely resemble the Indian hill tribes. The drive from Tizzi Ouzon, the Simla of Kabylia, to Fort National, should not be missed; but we were unfortunate enough to perform the journey in a blinding snowstorm. There is a small inn for the accommodation of travellers at both Tizzi Ouzon and Fort National.

Leaving the mountain capital next day we descended into the genial warmth of the plains and made our way back again to Algiers, and two days later set out for England, having spent a most enjoyable, and by no means expensive, holiday in Algeria.

Reviews.

GUIDE TO PROMOTION FOR NON-COMMISSIONED OFFICERS AND MEN OF THE ROYAL ARMY MEDICAL CORPS, with Appendix on Hints to young N.C.O.'s on Clerical and other duties in a Military Hospital. Compiled by Captain S. T. Beggs, M.B., R.A.M.C. (M.). London: Gale and Polden, Limited. 3s. 6d. net.

This book contains useful information and instruction in a concise and handy form, and should prove a useful handbook for junior N.C.O.'s and men of the Corps.

It certainly should realise the hope of the compiler that, "it will fulfil a useful purpose in the Corps and induce men to go in for promotion;" as, by young soldiers having the information before them in handy form, they will be able readily to see what is required for study. The usefulness of the book would probably be increased by blank leaves being placed between each chapter, for notes; and, if each answer had the Regulation, from which it is taken, quoted in the margin. There are a few errors, which the compiler might rectify in the next edition, e.g., "paragraphs 160 to 189 of the Corps Manual," p. viii.—these are the paragraphs in the 1899, not the 1904, edition. The Surgical Haversack and Medical Companion shown on pp. 153 and 155 are 1898 pattern—there is a 1905 pattern of each. In Addenda, p. 260, the Medical Equipment of a "Brigade Bearer Company" is given—there is no such field medical unit. A man is not now warned for duty in the manner stated on p. 60.

SOME LESSONS FROM THE RUSSO-JAPANESE WAR. By Colonel J. A. L. Haldane, C.B., D.S.O. Aldershot Military Society. Publishers: Messrs. Hugh Rees, Limited, 119, Pall Mall, London, S.W., from whom copies at 6d. each may be obtained.

As there is a good deal of fable mixed up with the truth in our conceptions of the Russo-Japanese War, we recommend this interesting pamphlet, which gives briefly the writer's views, come to while acting as military *attaché* with the Japanese Army.

He points out in his introduction that "The Japanese Army is, as all know, like the armies of the Continent of Europe, a national one, and, for that reason, contains within its ranks the flower of a nation numbering some fifty million souls. Yet, such is the national spirit of Japan that, though nominally raised by compulsion, the army is, in a general sense, a voluntary one; for officers and men are alike proud to give their services and fit themselves to help in preserving the integrity of their native land.

"An army that exists under such conditions possesses many advantages. Japan, too, in the war with Russia, was fighting for existence, her instinct of self-preservation was aroused and no dissentient voice was heard within the borders of her Empire.

"Her armed forces had been trained for years with one specific object,

and one only, and the study of war was limited to the precise means necessary to attain that end."

The part which deals with Japanese "Preparation for War" is particularly good, and we quote the writer's remarks which refer to the subject of military hygiene. . . . "Once a fortnight, in peace time, the medical officer of each unit in the Japanese Army lectures to the officers and men on matters connected with that subject, explaining to them how to preserve themselves, as far as possible, from illness in the field. The company and section officers, who are provided with a pamphlet regarding care of health, take other opportunities of impressing on those under them the necessity of avoiding all causes provocative of sickness, as an evil responsible for greater losses in the ranks of the army than the bullets of the enemy. In the field, by keeping up the men's spirits, there is far less liability to disease, as statistics of the campaign show, and the Japanese soldier looks upon it as a disgrace to be invalidated.

"A good deal has been said of the way in which the soldier is always provided with boiled water. Until towards the end of the campaign no special arrangements on that head were made; each soldier filled his water-bottle and boiled it for himself, and in doing so he complied with his own tastes, for the Japanese as a nation are great tea drinkers and do not mind quenching their thirst with hot or tepid water.

"I may here take the opportunity of correcting a statement which has obtained wide publicity, and has appeared again in a recent work on military hygiene. It is to the following effect: 'The Japanese medical officer is omnipresent. You will find him in countless places. He is with the first screen of scouts with his microscope and chemicals, testing and labelling wells, so that the army to follow shall drink no contaminated water.' This statement, which exceeds the actual fact, owes its origin to an American volunteer surgeon, and will be found in a work published by him. The writer of that work happened to be at Newchuang when some Japanese troops arrived there after the battle of Ta-shih-chiao. With these troops was a medical officer who was seen examining a well, but that officer made use neither of a microscope nor chemicals, which were admittedly added by the narrator of the incident for the purposes of embellishing his story. Such methods of testing water are not employed by medical officers with troops, although they are in force in field hospitals and on the line of communications.

"While speaking on the subject of water, I may remark that the Japanese soldier either exercises great self-control or is not a thirsty person. His water-bottle only carries very little more than one pint, a quantity with which, from difficulty of replenishment, he was forced to be satisfied during a long day's fight. Practice, no doubt, has helped him to control his thirst, and the possession of that control is undoubtedly a valuable asset."

Current Literature.

The Serum-Treatment of Plague.—In *Le Bulletin de l'Institut Pasteur* for June 15th, 1906, Dr. Dujardin-Beaumetz reviews the history of the serum-treatment of plague from the time of Yersin's discovery of the pathogenic agent of bubonic plague in the Hong Kong epidemic of 1894 up to the present date.

The technique of immunisation is a simple but lengthy one; it consists briefly in injecting into the jugular veins of horses an emulsion of plague microbes killed by heat, followed by weekly injections of living bacilli gradually rendered more virulent by "passage" through guinea-pigs and rats. This process has to be continued for five or six months before an antitoxic serum can be obtained suitable for human therapeutics.

The activity of the anti-plague serum is tested in the following manner: two mice each receive a plague inoculation by simple skin puncture; sixteen hours afterwards one of them receives an injection of $\frac{1}{10}$ of a cubic centimetre of serum, and this mouse survives whilst the other dies within forty-eight hours after inoculation.

In man the efficacy of the anti-plague serum has been fully proved, but its action is unfortunately a transitory one, lasting only for ten days; when the plague centre is a restricted one, then injections are of great value, but in a country where plague is endemic, the use of the serum as a preventive measure is out of the question. In this case, recourse must be had to injections of an emulsion of microbes killed by heat, according to the method recommended by Haffkine. This method confers an active immunity, which, although not so rapid in its onset, may yet last for several months.

The author now briefly recapitulates all the world-wide preventive inoculations for plague which took place between 1896 and 1905, both years inclusive. The results varied greatly, even in the same year, the mortality ranging from 5½ per cent. to 72½ per cent.; the difference is accounted for as follows: (1) the serum was administered too late; (2) or in insufficient doses; (3) or rarely by intravenous injection; (4) lastly, the sero-therapeutic treatment was suddenly stopped on the fall of temperature, the patient dying on the fifteenth and even on the thirtieth day after the last injection.

The therapeutic action of the serum also varies according to the period of the disease at which intervention takes place, the quantity injected, and the method of introduction. As far back as 1898, Simond showed that those who received the serum on the first day of the disease had a mortality of only 20 per cent., those treated on the third day 36 per cent., on the fourth day 66 per cent., and on the fifth day 100 per cent.

If early intervention in the treatment of plague has so favourable an influence on the prognosis of this disease, the quantity and the method of administration of the serum are no less of importance. The doses must of necessity be larger than those used in general practice (*e.g.*, in diphtheria, where Löffler's bacillus has only a limited action), for

in plague, from its very onset, the glandular affection may become generalised and the *Bacillus pestis* may appear in the circulation.

If given *subcutaneously*, the dose should be from 200 to 300 cc. and even higher, but this method necessitates one's having enormous quantities of serum at one's disposal, which is not always feasible during an epidemic; but if administered *intravenously* the organism is immediately saturated with antitoxin and by lesser doses; not less than 100 cc. are injected (on the first onset of symptoms) into the veins of the back of the hand or on the front of the wrist, and a similar injection is repeated twenty-four hours afterwards, and if there is still no sensible amelioration in the patient, a third one must be given. The serum must be thoroughly clear and slightly warmed before administration. A drop of collodion on the puncture made by the needle of the syringe is all that is required by way of dressing. There is usually some reaction after these injections, but the symptoms then cease suddenly as if by crisis. The accidents due to the serum are only those usual after the use of ordinary therapeutic sera, and are due only to the toxic products normally contained in horse blood serum.

To sum up, the only really efficacious treatment of plague is that by sero-therapeutics, and it cannot be too strongly insisted on that the best method for the administration of the anti-plague serum is that by *intravenous* injection and in *large doses*, for it is by these means that the best results have hitherto been obtained, and that it will be possible to successfully combat plague, of which the victims are still far too numerous.

J. E. NICHOLSON, *Lieutenant-Colonel (R.P.)*.

Tropical Sore or Delhi Boil.—Fresh interest has been aroused in the subject of "Tropical sore," "Delhi ulcer," or "Aleppo boil," as it is designated in the "Nomenclature of Diseases," since the discovery in them of structures in appearance akin to the parasites of kala-azar, first seen by Leishman in 1900.

R. P. Strong has contributed a valuable paper to the *Philippine Journal of Science*, January, 1906. He gives a *resumé* of the literature of the subject comprised in forty-eight articles to which he has referred. Among the earliest observers have been British Army Surgeons. Smith, in our Army Medical Report for 1868, gave an account of "Delhi boil." Frazer, in the same publication, attributed its causation to the bite of a fly or insect. Fleming, in the Army Medical Report for 1869, described its minute anatomy. His attention was chiefly directed to cells of yellowish-brown colour, with walls easily destroyed by pressure. Liq. potassæ produced in them an appearance of little globules of reddish colour which were insoluble in ether. These were probably the specific bodies: Leishman's parasites are just discernible in sections thus treated. Fleming proved that these cells were pathogenic, for he inoculated himself with them. A typical Delhi boil resulted after an incubation period of ten days, which pursued the usual course for a month, when he had the affected area destroyed with caustic potash. In 1885, D. D. Cunningham (*Scientific Memoirs of Medical Officers of the Army of India*) recorded the presence of bodies which varied considerably in size. "The average diameters of a series of measured specimens were 12·6 μ by 8·8 μ The distinctness with which they appear in sections treated with gentian

violet is due to the elective staining of the nucleoid bodies which they contain, by the dye. The number of such bodies present in different cells varies extremely. In some cases only a single great nucleoid mass is present seemingly occupying almost the entire cell body. In others, a few of very various sizes occur, and in still others a large number of minute and fairly equal-sized ones are thickly scattered throughout the entire cell. The tuberculate appearance presented by some of the cells is due to the number and size of the nucleoid bodies present in them, which, in association, form a mulberry-like mass pressing upon the cell wall, and moulding it to the inequalities of its surface. Such tuberculated bodies on superficial examination present certain points of resemblance to the characteristic bodies in cases of actinomycosis." This extract from Cunningham's original paper has been given at length, since it has been erroneously stated that the above description tallies with that of the parasites found by Leishman in the spleens of kala-azar infection.

Leishman says, in his classical report to the *British Medical Journal*, May 30th, 1903: "On making smear preparations from the spleen pulp. I was struck by the curious appearance among the spleen cells and red corpuscles of enormous numbers of small round or oval bodies, 2 to 3 μ in diameter, which corresponded to nothing I had previously met with or had seen figured or described. They stained faintly with methylene blue and with hæmatin, showing with these stains a sharply contoured circular or oval shape, but no detailed structure; but on staining them by Romanowsky's method, they were found to possess a quantity of chromatin of a very definite and regular shape, which clearly differentiated them from blood plates, or possible nuclear detritus. This chromatin appeared in the form of a more or less definitely circular mass or ring, applied to which, though apparently not in direct connection with it, was a much smaller chromatin mass, usually in the form of a short rod set perpendicularly, or at a tangent, to the circumference of the larger mass. The outlines of the sphere or oval enclosing these masses of chromatin were only faintly visible by this method of staining. These little bodies were scattered freely among the cells, as a rule isolated one from the other, but here and there aggregated into clumps composed of twenty to fifty members." It is seen that there is little in common in these two accounts. Moreover, Leishman's bodies cannot be identified in sections stained according to Cunningham's directions, on account of the diffuse coloration of the cell in which they are contained. In Cunningham's figures the "nucleoid bodies" are 6 to 8 μ in diameter, and suggest degenerated nuclei.

J. H. Wright also remarks: "From Cunningham's description of these bodies the morphological evidence adduced in favour of their parasitic nature is not sufficient to overcome the objection that they are elements of the tissue or degeneration products."

R. H. Firth (*British Medical Journal*, vol. i., 1891, p. 62) published a paper headed "Notes on the Appearance of certain Sporozoid Bodies in the protoplasm of an 'Oriental' Sore." In it he describes bodies which he names *Sporozoa furunculosa*. "Under a low power, these bodies appear to be homogeneous, but when highly magnified (900 times), are seen to be granular or to contain numbers of minute spore-like bodies. Either grouped or in individuals, these bodies seemed to be surrounded

by a more or less clear space." The drawings of the intracellular structures which illustrate his paper show that they are 2 to 4 μ in length and thus approximate in size to Leishman's parasites. He states he found similar bodies in the ulcer of a dog's back in India.

The next noteworthy advance in the etiology of this condition was made by Borowsky in 1898. He found in twenty cases of "Sarten ulcer" parasites 0.5 to 3 μ long, which had active motility. The cell body stained faintly; under Löffler's methylene blue a nucleus became evident. He was unsuccessful in his cultivation experiments. Schalgin, in 1902, examined fourteen cases and confirmed Borowsky's results. He thought the parasites multiplied by division. The original papers of both the last quoted authors are in Russian, and are not found in London libraries. Reference to their figures could therefore not be made.

In 1903, J. Horner Wright made a great stride in the study of the pathology of tropical ulcer by the use of Romanowsky's method of staining. With it he displayed forms which very closely resemble in appearance Leishman's bodies. Both his description and plates would serve nearly equally as well for the latter.

Marzinowsky and Bogrow found similar structures in a case of "Perydeh ulcer." They note what has been previously mentioned, that staining with the usual aniline dyes, the entire body became coloured and the nucleus could not be differentiated. Stained with Giemsa's modification of Romanowsky's dye, a macro- and micro-nucleus were visible. Attempts to cultivate the organism met with no success. Their report, published in Virchow's *Archiv*, 1904, contains an excellent summary of the literature of tropical sore. Structures in the form of Leishman's bodies are well depicted in their plates.

A. Plehn (*Handbuch der Tropenkrankheiten*, 1905) has examined one case, and James (*Sci. Mem. Officers Govt. India*, No. 13, 1905) has investigated eighteen cases. They have found the peculiar bodies in all.

Strong has observed the organisms in one. There can be no doubt as to the identity with the structures described by the previous investigators. His description and photograms are sufficiently convincing. In opposition to most other writers he concludes that these bodies are not protozoa but are forms of blastomyces (torulæ). He says, "There can be little doubt as to the nature of the parasites encountered in my sections. They are, I believe, forms of blastomyces, though they are very different from the usual species of blastomyces encountered in certain human skin affections. After a careful comparison of these bodies with those which have been found in ulcerations of the skin occurring in horses in the Tropics suffering from blastomycetic infection, I believe that the parasites of the two diseases are probably identical. . . . It is perhaps possible that, had I not been familiar with the appearance of torulæ encountered in this affection of horses, I might have mistaken these forms in the human lesion for protozoon-like bodies. . . . There is another point in favour of the identity of the two affections, the impossibility of cultivating the organism on artificial media." Strong's researches show the lack of wisdom on the part of those writers who hastened to assume the identity of the bodies found in tropical sores with Leishman's splenic parasites purely on morphological grounds. With as little reason could we assert that the *Herpetomonas* described by Rogers,

Leishman, and others, as occurring in cultures of the splenic parasites, were first recognised and described by Burnett, in 1851, who discovered a *Herpetomonas* for the first time in the intestinal canal of the house-fly.

C. BIRT, *Lieutenant-Colonel, R.A.M.C.*

[Films of scrapings from Delhi boils and from blastomycetic skin affections of horses and mules, which have been very common in South Africa, would be much valued if sent to the Laboratory, Queen Alexandra Hospital, Millbank, S.W.]

Correspondence.

THE STUDY OF TROPICAL DISEASE.—SCHEME FOR INDIAN RESEARCH.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

MY DEAR COLONEL BRUCE,—I enclose herewith a cutting from the *Pioneer* which may interest you. It is an official communique.

Yours, &c.,

E. D. W. GREIG.

*Central Research Institute,
Kasauli, Punjab, India.
June 9th, 1906.*

"Simla, June 6th.

"The following is a summary of correspondence between Lieutenant-Colonel J. T. W. Leslie, M.B., I.M.S., Sanitary Commissioner with the Government of India, and the Secretary to the Government of India in the Home Department:—

'I have the honour to lay before you a scheme to assist and supplement the work of laboratories in the investigation of Indian diseases. As you are aware the subject of tropical pathology is advancing with great rapidity, and while we may expect that our laboratories will enable India to keep pace with other countries in the advance, it is desirable that we should not only train a larger number of workers than can be employed in laboratories, but that we should offer sufficient instruction to every officer who desires to avail himself of it to enable him to make some use of the opportunities for original research which his daily work affords. To illustrate what I mean, we require officers who are sufficiently skilled to render their work trustworthy to carry out investigations regarding malaria, *kala-azar*, Delhi boil, &c., in different parts of the country, and if a few of the officers in medical charge of jails had the skill and appliances and time to carry out preliminary investigations into the nature of diseases classified under the heading of dysentery, which are a cause of great mortality in our prisons, we should be in a fair way to reduce that mortality.

'I would propose that a limited number of officers who have shown aptitude, or who there is good reason to believe are possessed of aptitude, for original research, should be deputed to a laboratory for a period of from three to six months for the purpose of prosecuting a research already begun, and for instruction. During such deputation the officer would receive the pay drawn by him in his appointment, but no deputation allowance. At the end of the period of deputation the director of the laboratory in which he has worked should report fully and confidentially regarding his qualifications and zeal, when the officer would be given special employment if his services could be spared, or would return to his appointment. If this portion of the scheme is approved officers should be informed through the authorities under whom they are serving, and invited to apply to be deputed, applications being accompanied by a record of training already undergone, and of original work accomplished, and supported by the recommendation of the Administrative Medical Officer concerned.

'When the Central Research Institute is open I hope that it will be possible to provide short courses of instruction in certain branches of investigation, of which Civil Surgeons, Medical Superintendents of Jails, and Regimental Officers should be encouraged to avail themselves. The courses would last about three weeks, and I would recommend that officers, who would be selected as accommodation is available from among those recommended by the Local Governments and the Military authorities, should be given their full pay and allowances, plus a deputation allowance of Rs. 5 a day, since the instruction is primarily for the benefit of Government, and a short deputation must entail loss.'

'The reply of the Government of India is as follows: 'In reply I am to say that for the present the Government of India would prefer to deal only with the case of officers referred to in paragraph 2 of your letter, that is to say, officers of the Indian Medical Service who may volunteer to go to a laboratory for a period of from three to six months for the purpose of prosecuting research already commenced, or for instruction in technique. The Government of India accept your proposals made on behalf of such officers, and have decided that the procedure to be adopted in dealing with their applications shall be as follows: (1) You will in the first instance address the Government of India, and in stating the applicant's case will suggest the laboratory to which he should be attached; (2) the Government of India will then consult the Director-General of the Indian Medical Service, and address either the Principal Medical Officer of His Majesty's Forces, or the Provincial Government concerned, explaining the circumstances, and leaving it to the Principal Medical Officer or the Local Government to decide when the officer in question can be spared from his ordinary duties; (3) no deputation allowance will be given; each officer will draw his own pay, less any allowance which he receives for local duties, and will be given travelling allowance for his

journeys to and from the laboratory ; (4) no addition to the sanctioned strength of the Indian Medical Service is contemplated ; local arrangements will be made for their ordinary duties, and for the purpose of recruitment they will be reckoned as present in their ordinary appointments ; (4) I am to add that there is no objection to the reception in laboratories in special cases of such officers of the Royal Army Medical Corps as may desire to prosecute a research, or to learn technique.' "

INDIAN ENTERIC AND LATRINES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—With reference to, and in support of, Lieutenant-Colonel Wardrop's short paper in your June issue, I might cite the case of Bangalore in 1904. In that year we had a sharp epidemic, about seventy-five cases, if my memory serves me aright. The disease first appeared in the Carabineers, and throughout the epidemic that regiment suffered more severely than any other unit. It was not until about two months or more after the outbreak that I was able to say that I could reasonably account for its origin and then it was more or less "a fluke." Chatting one day in the wards to the first victim after his convalescence, he casually mentioned that a man of the Warwicks who had been sent from Belgaum for change had slept in the next bed to him. Never having heard anything before of this man I made inquiries and found that he was an enteric convalescent, that it was not known whether he had bacilluria, and that urotropine had not been given. Naturally this man used the same latrine as the other men in the barrack room, and others in the same room were amongst the first sufferers. The latrines in Bangalore are specially designed to favour the cultivation of *Bacillus typhosus* : the floors are unpaved and inches deep in dust, stone and lime have been used with a prodigal hand, and even a tender regard for the comfort of the sweeper is manifested, for not content with a mere back wall, it was joined to the main building by a roof. The resulting effect on ventilation may be imagined. We had this roof removed, which certainly improved matters. For many a long day I had been inclining more and more to the belief that the fountain head of infection was latrines, either through the intermediary of flies, by direct dust infection, or both, and when the disease was raging in the Carabineers I determined to try an experiment. I argued that since we could prevent its spread in a hospital we could do it outside also, so I abandoned the dry-earth and substituted crude carbolic and chloride of lime ; but further, I had "chulas" dug immediately in rear of the latrines and, utilising the ordinary air-tight receptacles for the purpose, I boiled the carbolised fæces before transferring them to the Crowley cart. This was done for

a month, with the result that the outbreak ceased. Query, was this cause and effect? Personally I think so, and Lieutenant-Colonel C. Melville, the then Command Sanitary Officer, will bear me out in this contention.

I am in full agreement with Lieutenant-Colonel Wardrop, and I believe that we can in great measure stamp out the enteric scourge in India if we adopt the following: (1) Remove latrines well away from cook-houses; (2) make them light and airy structures, easily moved if necessary; (3) pave them with cement; (4) abolish dry-earth and substitute crude petroleum or carbolic; (5) let the seats be movable and the pans so placed that slopping is impossible; (6) eliminate flies; (7) scrupulous cleanliness, not make-believe, but scientific; (8) early sterilisation by boiling, if possible on the spot, and before transit; (9) efficient means of transit, in water-tight vehicles; (10) frequent sterilisation of all receptacles; (11) careful and scientific disposal at a distance.

There may be differences of opinion as to the best manner of carrying out these principles, but in the absence of sewers and a water system no Indian sanitarian will, I venture to assert, gainsay the soundness of the premises. The difficulty, of course, is the perennial one, "expense." An useful catch-phrase in Indian legislation, carrying with it just that amount of weight which it merits. One thing is certain, however, that without expenditure, and free expenditure, enteric will still hold sway; therefore, it resolves itself—outside humanitarianism—into a simple question of values: in short, is the result worth the cost? I think it is, and well worth it; but if the expense "bugaboo" is too alarming to face in bulk, so to speak, why not select a few stations primarily for the purpose of experiment, stations such as Quetta, Rawal Pindi, Umballa, Poona and Bangalore—all notorious as hot-beds of enteric—select your staff of officers to apply the above-mentioned principles, do not grudge a free expenditure, and I am bold enough to prophecy that the results obtained would be so convincing that not even the most hide-bound sceptic could fail to appreciate them.

Yours faithfully,

Bombay,

June 25th, 1906.

R. H. FORMAN,

Colonel R.A.M.C.

HAMMER TOE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Colonel Poynder, in referring to the nomenclature of "hammer toe," states: ". . . 'hammer toe' which in the 'Nomenclature' is applied to a fixed, straight, hammer-headed great toe,"

The text of the nomenclature is simply:—

797a. Deformities of the great toe.

b. Hammer toe.

The foreign equivalent :—

Latin.	French.	German.
b. Hallux flexus.	Hallux flexus.	Hallux flexus.

Surely this cannot be interpreted to mean "a fixed, straight, hammer-headed great toe." I believe it is generally admitted that *Hallux Valgus* will certainly follow removal of the second toe. Since excision of the head of the first phalanx gives such good results, why send the recruits to have this toe removed?

Yours very truly,

Jhansi,
July 27th, 1906.

ALFRED J. HULL,
Captain R.A.M.C.

RECRUITING ; OPERATION ON INTENDING RECRUITS SUFFERING FROM HERNIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—May I suggest that intending recruits who may be suffering from hernia, and who are in other respects *most desirable*, should be enlisted, provided that they sign a document to the effect that :—

- (1) They will submit to immediate operation in a military hospital.
- (2) That they will not receive pay for three months after enlistment.

By the end of this time they should be in a condition to commence their military training, except that gymnastics should be postponed for another three months.

It appears to me that, seeing a man enlists for seven years, it might pay the Government to provide free board and lodging for such suitable cases for three months, rather than lose them altogether.

I am, &c.,

Colchester,
August 11th, 1906.

F. J. W. PORTER,
Major R.A.M.C.

Journal
of the
Royal Army Medical Corps.

Original Communications.

REPORTS OF THE COMMISSION APPOINTED BY THE
ADMIRALTY, THE WAR OFFICE, AND THE CIVIL
GOVERNMENT OF MALTA, FOR THE INVESTIGA-
TION OF MEDITERRANEAN FEVER, UNDER THE
SUPERVISION OF AN ADVISORY COMMITTEE OF
THE ROYAL SOCIETY.

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(Continued from p. 254.)

REPORT ON THE PREVALENCE OF MEDITERRANEAN FEVER
AMONGST BRITISH TROOPS IN MALTA, 1905.

BY LIEUTENANT-COLONEL A. M. DAVIES.

Royal Army Medical Corps; Member of the Mediterranean Fever Commission.

It is worth while considering a converse instance; D and F Companies went from St. Elmo to Gozo on September 1st, 1904, and returned to St. Elmo on May 8th, 1905. From these two companies two cases of Mediterranean fever were admitted on September 8th, 1904, one on September 18th and one on October 3rd; the first three and perhaps the fourth case may be presumed to have become infected before leaving St. Elmo; a fifth case was admitted on October 8th (thirty-eight days after leaving St. Elmo), and not a single other case occurred during their eight months' stay at Gozo, nor (with one exception) during their stay at St. Elmo between May 8th and July 8th; four cases were admitted at

Intarfa during the latter half of July. The one case admitted after return to St. Elmo that appears to have contracted the infection in Gozo (Private Lawrence, F Company) was admitted on May 21st, thirteen days after arrival. Whatever the conditions were that led to the prevalence amongst the occupants of Lower St. Elmo, they appear to have been absent from Gozo even more completely than from Intarfa. The immunity enjoyed by these two companies while at Gozo continued for two months after their return to St. Elmo, yet in G and H Companies twenty-one cases occurred in the same two months, May 8th to July 8th, 1905.

The 2nd Essex having marched up to Intarfa on July 8th, their quarters in Lower St. Elmo were taken over by the 1st Lancashire Fusiliers, who marched in on July 11th. This regiment had landed in Malta from England on February 27th, 1905, and on arrival were quartered in Polverista Barracks; they marched to Pembroke Camp on March 20th, thence to Mellieha Camp on April 30th, and returned to Polverista on May 8th, remaining there until their move to Lower St. Elmo. Six companies then occupied these barracks, and two (B and D) went into Manoel Hutments.

The first admission to hospital for Mediterranean fever occurred on April 5th, that is thirty-seven days after landing in Malta; the second admission was on April 17th; until their move to St. Elmo there were eighteen other admissions, that is, twenty in fifteen weeks; during the same period the Essex Regiment had fifty admissions; the prevalence in the Lancashires was, therefore, much less than in the Essex. During the next four weeks eight cases were admitted from Lower St. Elmo, having presumably contracted infection in Polverista. From August 9th to the end of September, nineteen cases occurred in the six companies in St. Elmo, and three cases in the two companies occupying Manoel, presumably due to infection contracted in those places.

In this regiment, unlike the Essex, the incidence on different companies has varied but slightly. During the whole period from their landing until the end of September (seven months) the distribution of cases has been as follows:—

A.	B.	C.	D.	E.	F.	G.	H.	Total.
5	4	9	8	8	5	4	8	51

There is here no marked preponderance, as in the case of B, G, and H Companies of the Essex. Before the move to St. Elmo the distribution had been thus:—

A.	B.	C.	D.	E.	F.	G.	H.	Total.
2	1	2	7	2	4	1	1	20

Within the next four weeks the cases occurred thus :—

A.	B.	C.	D.	E.	F.	G.	H.	Total.
1	1	2	0	2	0	1	1	8

From August 8th until September 30th the cases occurred thus :—

A.	B.	C.	D.	E.	F.	G.	H.	Total.
2	2	5	1	4	1	2	6	23

In the first set of twenty cases D Company certainly furnishes a disproportionate number, but no common origin is apparent, and the cases were spread over three months. It may be noted that two cases in A Company were admitted from the same room (No. 3 Polverista), and two cases in F Company also from one room (No. 14 Polverista). These rooms accommodate fourteen men in each. The battalion was quartered in a number of small barracks, including not only Polverista itself, but also all the others making up Cottonera Lines, and was therefore widely scattered. On coming to Lower St. Elmo six companies were concentrated in one building under like conditions. It is to be noted that seven cases occurred in C Company, which occupied Nos. 5 to 8 rooms in the middle storey, the same that had just been vacated by G Company of the Essex Regiment; this company had furnished nineteen cases of Mediterranean fever, thirteen of which appear to have contracted infection while occupying these four rooms, seven of these having been admitted within the preceding three weeks. Of the seven cases in the Lancashires one was a colour-sergeant who occupied the same room as a colour-sergeant of the Essex, admitted with Mediterranean fever eight weeks before; of the other six, three cases came from No. 7 room, a room from which two cases at least had been admitted in the Essex Regiment within the preceding six weeks. Is it a mere coincidence that six men should be admitted from the same four rooms as had furnished seven cases in another regiment during the few weeks immediately preceding?

The other company that showed a relatively large number of admissions after arriving at St. Elmo was H Company; seven cases occurred between July 11th and the end of September; they were admitted from the four rooms, Nos. 10 to 13, in the upper storey; two of these came from the same room, No. 12, on September 22nd and 25th respectively. These rooms had been occupied between May 8th and July 8th by F Company of the Essex Regiment, which had arrived from Gozo on May 8th, and did not show any especial prevalence during its stay at St. Elmo; shortly after arriving at Imtarfa, however, three cases occurred, on July 13th,

24th and 28th, which had presumably contracted infection when staying in the rooms now mentioned.

With regard to the other group of cases, in C Company, the position may be stated thus: We have a body of men that have been living in Malta for rather over four months, and in that period have furnished two cases of Mediterranean fever, apparently arising at two different places (Pembroke Camp and Corradino Prison), and with a month's interval between the two, the last admission having been six weeks since. This body of men now move into fresh quarters, consisting of four rooms, just vacated by another group of persons, who have furnished eleven cases of fever during the year up to the date of leaving, seven having been admitted during the preceding three weeks. Out of the new company four are seized with the fever within six weeks. There is, I submit, a presumption that the infective agent is connected with the *place*. If this be considered a reasonable presumption, a further point to be noted is that the first admission amongst the fresh body of men occurred twenty days, and the second twenty-two days, after their arrival at the presumably infected barrack rooms, indicating an incubation period of about twenty-one days.

An examination of the incidence of Mediterranean fever in these two bodies of men, the Essex and the Lancashires, so far indicates that the disease may prevail in a strictly localised fashion. Both these battalions have occupied old barracks with many sanitary defects; the next case to be considered is that of a battalion living in good modern barracks in a healthy situation.

§ 3.

The 1st Royal Dublin Fusiliers have occupied St. George's Barracks, Pembroke, since March, 1904; they arrived in Malta from South Africa, in November, 1902; in February, 1903, five companies left for Crete and Cyprus, the remaining three being stationed at Imtarfa. At the beginning of March, 1904, the whole battalion came into St. George's. During 1904 only four cases of Mediterranean fever occurred, one of which was contracted in Cyprus. Therefore, the battalion and the barracks were almost exempt from the disease during 1904. During the nine months, January to September, 1905, there have been forty-one admissions. The different companies have suffered very unevenly, thus:—

A.	B.	C.	D.	E.	F.	G.	H.	Total.
13	6	5	3	8	2	3	1	41

It is seen that A Company has suffered most, with thirteen cases; and H Company least, with only one case. In A Company there was a sequence of five cases between June 16th and July 6th; and again a sequence of cases between August 16th and September 15th; in D Company three cases occurred close together between August 16th and 30th; and in E Company there were three cases between August 11th and 14th, and again three cases between August 27th and September 10th.

There is a noteworthy circumstance in connection with the company incidence of Mediterranean fever in this regiment; A Company, which had thirteen cases, and H Company, which had only one case, occupy the same barrack block, lettered F; the companies are of the same strength; they each occupy seven barrack rooms; A Company having those in the eastern half, nearest the sea, and H having those in the western half. The two companies use the same cookhouse, the same ablution room, the same latrine and urinal. The barrack block is one of six single-storey buildings, and consists of fourteen rooms all alike, measuring 30×21 feet by 14 feet in height, and accommodating thirteen men in each, with an allowance of 605 cubic feet per head. Although there are no openings in the sides of the rooms, the door and two windows at each end, and the roof ventilators, appear to provide sufficient means of entrance and exit for the free circulation of air; the rooms seem to be airy and well ventilated. There are also in each block six bunks for non-commissioned officers; these are placed back to back, with no through ventilation, and are certainly hot and stuffy; none of the fever cases in this company occupied any of these bunks; the sergeant, who was admitted on May 29th, lived in A Block, Married Quarters. Though these barracks are not of the most modern type, I can find no fault with their essential sanitary conditions; the cookhouses and ablution room are excellent, the drainage system is modern, and, with trifling exceptions, of good construction; the drains are kept in excellent order, and the sanitation of the lines carefully attended to. The one important sanitary defect is the scarcity of water for flushing purposes, leading to a foul state of the water latrines of occasional, or perhaps frequent, occurrence. As regards situation, nothing better could be desired; they form a complete contrast to Lower St. Elmo and Floriana Barracks, and the extremely objectionable places occupied by troops in Cottonera Lines. They are freely exposed to the air on all sides, with no habitations near, and in three directions are practically open to the sea. Complaint was

made by some men occupying No. 14 room (the one nearest to the sea) of bad smells coming from the sewer outlet into the sea in this direction. With the existing scarcity of water for flushing purposes, no doubt the drain air is occasionally offensive and the sewage malodorous; but I do not think that any harm could result to the occupants of these barracks therefrom; the outlet is many hundred yards distant from any of the buildings.

There does not appear to be any condition affecting A Company that does not equally affect H Company, and as the latter has been immune to Mediterranean fever throughout 1904 and 1905, to the end of September (with the exception of one case), the cause for the prevalence in A Company is not obvious. The drinking-water supply and the milk supply are common to the whole regiment; the milk has been boiled, not by companies separately, but by the master-cook centrally for all; therefore, whether effectually sterilised or not, it has been consumed in the same—boiled or unboiled—condition by all companies alike.

In these barracks, as in most of the older barracks in the island, it has been the practice to affix the accoutrement shelves to the walls of the rooms in a continuous line, and not to separate them from each other as far as the linear space will allow. It is the custom to arrange the bed-cots in symmetrical order, each under the shelf that holds the occupant's kit and accoutrements. The length of the shelf is three feet five inches, the width of the bed is two feet five inches; consequently, when the shelves and beds are so arranged, there is only a space of twelve inches between bed and bed. Although the occupants have each 605 cubic feet of air space in the room, they are not evenly distributed so as to get each one his fair share, his one-thirteenth part, of the total cubic space; but they are crowded together, with only a foot between each pair of beds. Now, whatever the *materies morbi* may be, if it be once introduced into a room arranged like this, infection from person to person will the more readily take place, the closer the men are crowded together. So that if we assume that there is a particulate *contagium*, capable of being conveyed from an infected to a non-infected person, such an arrangement as now described would facilitate spread of the disease, when the *contagium* has been once introduced, or has been introduced in sufficient quantity. But until it has been introduced, the arrangement would have no effect. In the case of these barracks, in which the sanitary conditions are uniform and (except for aggregation of beds and scarcity of flushing water) satisfactory, this

aggregation offers a plausible explanation of the *spread* of the fever, though not of its origin.

§ 4.

There are eight companies of Royal Garrison Artillery quartered in Malta, their total average strength for the first nine months of 1905 amounting, with the District Staff, to 1936 : in this body of troops there occurred eighty-eight cases of Mediterranean fever (besides seven cases contracted in hospital), giving a ratio of 45·34 per 1,000. There was, however, considerable variation in the prevalence in the different companies, as shown in the following table :—

ROYAL GARRISON ARTILLERY.

		Strength	Cases	Attack ratio per 1,000
No. 1 Company	..	190	13	68·4
5	..	235	8	34·0
63	..	216	4	18·5
65	..	205	17	82·9
96	..	217	15	69·1
99	..	222	12	54·0
100	..	240	10	41·7
102	..	215	7	32·5
District Staff	..	196	2	10·2

The men of the Garrison Artillery in Malta are, as a rule, older and of greater length of service than the average infantry soldier : a larger proportion also have already had foreign service. As to length of stay in the island, two of these companies (63 and 99) arrived in 1902, two (99 and 100) in 1903, and the other four in 1904 ; it is not unusual, however, for men to exchange from one company to another, and under present arrangements the companies do not move from station to station *as a body*, but change their *personnel* by individual reliefs. The two companies that have been longest in Malta show a great difference in their fever incidence, No. 63 having had 18·5 cases per 1,000, and No. 96 having had 69·1 cases per 1,000 ; Nos. 99 and 100 arrived together, and show a similar incidence, 54·0 and 41·7 per 1,000 ; Nos. 1, 5 and 65 arrived together, but show an incidence very unequal, viz., 68·4, 34·0 and 82·9 per 1,000 ; No. 102, which arrived three months earlier, only 32·5 per 1,000. It does not appear that length of residence in Malta can account for the great variation in this year's prevalence of the fever in the Artillery.

The variation, however, has a relation to the barracks in which

314 *Reports of the Commission on Mediterranean Fever*

the different companies have been quartered. Two companies have been stationed at St. Elmo, three companies at Tigne (with a detachment at St. George's for a part of the time), and three companies at Ricasoli, thus :—

Upper St. Elmo—						
No. 65	..	..	..	17 cases	82.9	per 1000
96	..	..	..	15 „	69.1	„
Tigne—						
No. 1	..	..	..	13 „	68.4	„
99	..	..	..	12 „	54.0	„
102	..	..	..	7 „	32.5	„
Ricasoli—						
No. 5	..	..	..	8 „	34.0	„
63	..	..	..	4 „	18.5	„
100	..	..	..	10 „	41.7	„
St. James Cavalier, &c.—						
District Staff	..	..	..	2 „	10.2	„

A portion of 65th Company has been accommodated in St. James Cavalier and Castille, but only one case of fever has occurred among the men of this detachment. All companies have from time to time sent detachments to the outlying forts and practice camps ; two cases have occurred in such detachments from 65th Company, and one from 96th Company. If these be deducted from the St. Elmo figures the incidence on the troops stationed there will be lessened, but the disproportion between the different barracks will not be diminished, for out of the ten cases in 100th Company, no less than five were apparently infected at outlying forts, and of the seven cases in 102nd Company two were similarly of outside origin. The numbers are too small to justify any important deduction, but it is certainly noteworthy that the companies quartered in Valletta have been much more severely affected than those at Ricasoli, those at Tigne occupying an intermediate place.

The barracks at Upper St. Elmo are not quite satisfactory, but are not nearly so bad as Lower St. Elmo or St. James Cavalier ; the chief points are defective latrine and urinal arrangements, and the continual use of tents, which must lead to fouling of the ground. St. James Cavalier is a very bad barrack, overcrowded and impossible to ventilate, with insanitary latrine conditions owing to scarcity of water ; Mediterranean fever has not, however, been prevalent there. On the other hand, the sanitary condition of Fort Ricasoli is, on the whole, satisfactory, except that the large barrack rooms are difficult to ventilate ; the situation of this fort is ideal, as is that of Tigne barracks, which last are in as good a state, sani-

tarily, as Ricasoli; the incidence of Mediterranean fever has, however, been greater at Tigne. I am not able to trace any definite connection between the degree of prevalence of Mediterranean fever amongst the different artillery units and the respective sanitary conditions of the barracks in which the units were quartered.

The isolation of Ricasoli from all native surroundings is fairly complete; this may be said in a lesser degree of Tigne; but from Tigne the men habitually go to spend their spare time in Valletta, whereas from Ricasoli it is not, I am informed, at all common for the men to cross the Grand Harbour to spend their evenings in the town. Isolation (habitual though not complete) does not, however, prevent the occurrence of the disease, as eleven cases have occurred amongst men stationed in outlying forts and camps, the disease having apparently been contracted in these places. Though situated in the open country, and generally near the sea, so as to be airy and healthy, there are certain insanitary conditions present in nearly all these forts. From the necessity of the case the sleeping rooms are imperfectly ventilated, though I did not find that there had been any overcrowding anywhere, except at Benghisa. In most forts the water supply was scanty, leading to parsimony in its use for latrine and urinal flushing, where water latrines are provided. Dry earth latrines are, however, in general use, and, with some few exceptions, are kept in an insanitary condition. With a scanty water supply, a very imperfect method of removal of excreta, and a minimum amount of air space, or air change, in the sleeping rooms, the forts cannot be called sanitarily satisfactory, but as regards the general health of the men quartered in them, it appears to be excellent in spite of these sanitary shortcomings. Two cases were admitted from Fort Delimara on the same day (August 10th), and two cases from Ta Silch within a week of each other (September 6th and 13th); in no other instance was there any apparent connection between cases at any of the forts.

Three cases were admitted on three successive days, May 18th, 19th, 20th, in No. 65 Company, from tents at Upper St. Elmo, but I was unable to ascertain if they had occupied the same tent. Two cases occurred out of eight occupants of the same room, No. 6, lower storey, in 96th Company, on March 23rd and April 19th. Two cases occurred in 99th Company in the same hut, No. 6; and two other cases also in the same hut, No. 8, at Tigne, within a fortnight of each other, in September; there were sixteen occupants in each hut. Within the space of fourteen days in August three men were admitted from No. 1 barrack room, Ricasoli, in 5th

Company, accommodating thirty-three men; and two men out of five occupying a room at the Auberge de Castille, and employed at the Royal Artillery officers' mess, were admitted on June 9th and July 29th. What connection there may have been between these cases is doubtful. No. 1 room at Ricasoli is especially difficult to ventilate; the room at the officers' mess is reported to be close and stuffy; the Upper St. Elmo rooms and the Tighe huts are sanitarily satisfactory.

§ 5.

There are two infantry battalions that have not suffered to any great extent from Mediterranean fever during 1905, but which offer a contrast, the one to the other. The 1st Royal West Kent Regiment arrived in Malta on April 15th, 1904, and after a month in camp at Pembroke and Mellieha were quartered in Floriana Barracks, where they have remained ever since, except for a month in camp in November and December, 1904, and again three weeks in March, 1905. One company however, B, was in camp at Ghain Tuffieha for three months from February 1st to May 1st. During the nine months thirty-seven cases of Mediterranean fever were admitted from the battalion, the distribution by companies being as follows :—

A.	B.	C.	D.	E.	F.	G.	H.	Uncertain.	Total.
6	1	4	1	5	3	7	8	2	37

The barracks occupied by this regiment are of a composite character. Three companies have been quartered in the "Old Barracks," which are casemates of the type so common in Malta; these are especially difficult to ventilate, on account of their great length, which is about eighty feet; they have, however, not been overcrowded, as the battalion has not been up to full strength, and the cubic space has therefore been nominally sufficient; instead of thirty men, not more than twenty-four have generally occupied one room. It is, however evident that an apartment eighty feet in length, with no lateral openings whatever, cannot possibly be supplied with a proper change of air by natural ventilation. Three companies have been quartered in the New Barracks, which consist of three separate two-storey blocks, constructed with every regard to the principles of modern sanitation; each room accommodates twenty-six men. One company has been quartered in Notre Dame Ravelin Barracks, a single storey building consisting of sixteen small rooms, with five men in each; and one company has been

divided between one room in the Old Barracks and two huts in the Ravelin; the band also occupy huts in the Ravelin; each hut accommodates eighteen men. A small detached fortress, the Salvatore Counterguard, accommodates a party of signallers, numbering thirty.

The number accommodated in the Old Barracks is 360, in the New Blocks 318, in the Ravelin and Salvatore 245; total 923. The distribution of cases of Mediterranean fever has been thus:—

A, C, and G (Old Barracks)	17 cases.
B, E, and F (New Barracks)	9 „
D (Ravelin)	1 „
H (Old Barracks and Ravelin)	8 „
Uncertain	2 „
	—
	37 „

Three companies occupying the Old Barracks have had seventeen cases; three occupying the New have had nine cases; one company occupying the Ravelin has had one case, and H Company, divided between the Old Barracks and Ravelin, has had eight cases. One case, however, in A Company was admitted, not from Old Barracks but from Notre Dame Ravelin (a bandsman); the one case in B Company, and one case in E, occupied huts in Ravelin, not the New Blocks; and one case in H was infected apparently in Pembroke Camp, not in the Old Barracks. Making these corrections it is seen that the admissions were as follows:—

From Old Barracks, accommodating 360	23
From New Barracks, accommodating 318	7
From N.D. Ravelin, &c., accommodating 245	4
From Pembroke Camp (1), Ghain Tuffieha (1)	2
Uncertain	1
	—
	37

It seems evident that the incidence on the body of men occupying the Old Barracks is disproportionate, although the numbers are too small to afford much ground for drawing any decided conclusion. In two instances there seems to have been a likely connection between cases; in A Company two admissions took place from No. 8 room, one on March 28th, the other on April 10th; in H Company three men were admitted from No. 3 room, on April 2nd, 9th and 24th; the exact room that a man slept in is not ascertainable in every instance, although it is generally possible to localise the part of the barracks occupied with some accuracy. It is quite clear that the battalion, as a whole, did not suffer uniformly, but that there was a prevalence amongst some groups of men, or in some portions of the barracks.

§ 6.

The 2nd Hampshire Regiment has furnished fewer cases of Mediterranean fever during the period under consideration than any other regimental group: there have been twenty-seven cases in a strength of 997 men. They arrived in Malta on September 16th, 1903, and have remained in Verdala Barracks all the time, with short yearly absences in camp. A portion of the battalion has occupied some of the smaller barracks in Cottonera Lines (Polverista, St. Clement's, &c.), but no especial difference is observable in the incidence of the fever upon these different detachments, the ratio for the whole battalion being 27 per 1,000 and for the Verdala portion 29.1 per 1,000. The cases occurred sparsely throughout the year, not more than six occurring in any one month (September), and no company contributing more than four; in only one instance has there appeared to be any connection between one case and another: a man was admitted from Zabbar Gate on July 6th, and another from the same place on July 15th.

The general sanitary condition and surroundings of Verdala and the Cottonera Lines are certainly not better than those of Floriana, and in one important respect, that of scanty water supply for flushing purposes, they have been much worse off; the small casemate rooms in Verdala are, however, much better ventilated than the large casemates in Old Floriana Barracks.

The 2nd Royal Sussex Regiment arrived in Malta from England on June 27th, 1904, and were quartered in Polverista and other barracks in the Cottonera Lines. They were in camp at Pembroke and Mellieha, four companies at a time, for a month in November and December; and the whole battalion together at Ghain Tuffieha for a fortnight in January, 1905. They marched up to Imtarfa on February 22nd and 26th, and on May 29th five companies, with the headquarters, left for Crete. During 1904 they suffered little from Mediterranean fever, having had only eleven admissions altogether; up to the departure of the five companies to Crete at the end of May, there had been seventeen admissions during 1905; these cases had been scattered about in different companies and barracks, and there was no particular incidence on any one company or barrack. Between June 26th and August 24th there were five admissions from C Company, all from the same barrack block (H), and two from the same room (No. 97), on August 4th and 10th; from this room also another man was admitted on September 21st. H Company occupies the other half of H block, from which four other cases were admitted between April and September, but no two from the

same room. The rooms vary in size, some accommodating sixteen and some twenty men; No. 97 accommodates twenty men.

§ 7.—HOSPITALS.

The total number of cases of Mediterranean fever that apparently contracted the disease in hospital, either as patients admitted for some other illness and subsequently developing this fever under circumstances pointing to hospital infection, or as non-commissioned officers and men of the Royal Army Medical Corps, and other men attached for nursing duties, amounted to 56. Of this number 33 occurred at Valletta Hospital, 17 at Cottonera. The accompanying table shows the distribution in detail. It is seen that, in all, 23 patients in hospital contracted the disease, 30 Royal Army Medical Corps, and three men attached for nursing duties:—

	Average number of patients	Average number R.A.M.C.	Cases of Mediterranean fever		
			Patients	R.A.M.C.	Men attached
Valletta	157	74	11	19	3
Cottonera	102	45	10	7	—
Forrest	47	10	1	2	—
Citta Vecchia ..	47	15	1	2	—
Imtarfa	25	8	—	—	—
Gozo	2	3	—	—	—
	380	155	23	30	3

The total average hospital population, including patients and orderlies, amounted to 535, amongst whom there occurred 56 cases of Mediterranean fever, being in a ratio of 104·66 per 1,000. Of these, 23 occurred in an average population of 380 patients, being in a ratio of 60·53 per 1,000; and 30 in an average population of 155 orderlies Royal Army Medical Corps, or 193·55 per 1,000. While the incidence is decidedly greater on the men of the Royal Army Medical Corps, this varies in the different hospitals; thus at Valletta the ratio among the patients was 70·1, among the Royal Army Medical Corps 256·8 per 1,000; at Cottonera, among the patients 98·0, among the Royal Army Medical Corps 155·6 per 1,000. The incidence upon the patients is not, however, fairly comparable either with that upon the Royal Army Medical Corps or with that upon any of the regimental units that have been previously considered; because the hospital *sick population* is constantly changing. The Royal Army Medical Corps prevalence can be fairly compared with that of any other unit, and the severity

of the outbreak amongst this body of men is immediately evident. The highest ratio in any regimental unit is that of the Essex Regiment, 88·33 per 1,000; and for any barracks, that of Lower St. Elmo, 137·03 per 1,000; for the Royal Army Medical Corps as a whole the ratio is 193·5, for those quartered in Valletta Hospital 256·8, for those at Cottonera Hospital 155·6 per 1,000.

The incidence upon the patients at Valletta Hospital, 70·1 per 1,000, was less than that upon the Essex Regiment; at Cottonera the patients suffered more, viz., 98·0 per 1,000; but these ratios are not properly comparable, as just mentioned.

The circumstances that lead to the opinion that the infection was contracted in hospital in the following instances will now be shortly stated, beginning with the sick under treatment for other forms of illness:—

CASE 1.—Private Minter, Essex Regiment, was admitted from Lower St. Elmo to Valletta Hospital on February 14th, with “gonorrhœa”; on March 25th he was transferred to Forrest Hospital; his “disease” was changed to Mediterranean fever on April 20th; it is almost certain that infection was contracted in one or the other hospital, more probably in Valletta than in Forrest.

CASE 2.—Private Salmon, Rifle Brigade, was admitted to Valletta Hospital for “debility” from Manoel Hutments, on March 24th, 1905. He was treated in 20 A Ward. He was transferred to Citta Vecchia Sanatorium, April 17th; and discharged to duty at Manoel, May 1st. He was again admitted to Valletta on May 14th, having been ill for about ten days. His illness commenced in the first week of May, and was contracted either in Valletta or Citta Vecchia Hospitals, most probably in the former.

CASE 3.—Gunner Jardine, R.G.A., was admitted to Valletta Hospital from Upper St. Elmo, suffering from “orchitis,” on April 3rd; he was transferred to Citta Vecchia on May 22nd, and the “disease” changed to Mediterranean fever on June 1st; his infection was almost undoubtedly contracted in Valletta Hospital.

CASE 4.—Gunner Moore, R.G.A., was admitted to Valletta Hospital from Upper St. Elmo, with “gonorrhœa,” on April 7th; his “disease” was changed to Mediterranean fever on June 13th, after more than two months’ stay in hospital, during which time he must have taken the infection.

CASE 5.—Private Bush, Essex Regiment, was admitted from Lower St. Elmo to Valletta, suffering from venereal disease, on May 24th; on June 6th he was transferred to Cottonera, and on June 26th began to be ill with Mediterranean fever; the infection

was probably contracted within the preceding thirty-three days, *i.e.*, after his admission to Valletta Hospital; but it is uncertain whether at Valletta or Cottonera; moreover, Mediterranean fever was prevalent at Lower St. Elmo in May. This is a doubtful case of hospital infection.

CASE 6.—Private Potter, Rifle Brigade, was in Valletta Hospital, with venereal disease, from May 16th to June 7th, when he was discharged to St. Andrew's Barracks. He was admitted to Forrest Hospital on June 29th, suffering from Mediterranean fever, having been ill for about one week before this; it is more probable that he took infection in Valletta Hospital before June 7th than in St. Andrew's Barracks between June 7th and 22nd; these barracks had just been completed and taken into occupation on June 2nd.

CASE 7.—Private Gerard, Rifle Brigade, was admitted to Valletta from Ghain Tuffieha Camp on May 14, suffering from gonorrhœa; on July 1st Mediterranean fever was diagnosed; infection was almost certainly contracted during the preceding six weeks in hospital.

CASE 8.—Private Wilding, Rifle Brigade, was admitted to Valletta, 20 A Ward, from Manoel on May 30th, with enteric fever; on July 16th he was found to be suffering from Mediterranean fever and the "disease" was changed; infection was probably contracted during the preceding forty-six days in hospital; unless it be supposed that a double infection had been contracted originally, and that the enteric symptoms and agglutination phenomena had masked those of Mediterranean fever.

CASE 9.—Gunner Marjerum, R.G.A., was admitted to Valletta on July 29th, with Mediterranean fever, having only been discharged from the same hospital ten days before, during three or four of which he was sickening with the fever; he had previously been under treatment in 20 B for six weeks (gonorrhœa), and in this period probably contracted the infection.

CASE 10.—Private Heaton, Lancashire Fusiliers, was admitted to Valletta from Lower St. Elmo on August 1st, with Mediterranean fever, having already been a ill few days. From June 28th to July 15th, he had been in the same hospital, treated for "debility," but without any symptoms of Mediterranean fever. It is more probable that infection was taken during the fortnight before, than during the fortnight after, July 15th; but the case is an uncertain one. The battalion had moved from Cottonera Lines to Lower St. Elmo on July 11th; several cases of fever had occurred, but not in this man's company, about that time.

(To be continued.)

ON THE PHAGOCYTOSIS OF TYPHOID BACTERIA.¹

BY CAPTAIN W. S. HARRISON.

Royal Army Medical Corps.

THE study of the rôle of phagocytosis in natural and acquired immunity, which was initiated by Metschnikoff, received a new impetus, especially in this country, when Leishman², in 1902, described a method for accurately measuring the activity of the phagocytosis of bacteria in a given blood. Wright and Douglas³, in 1903, introduced a modification of this method, which enabled one, not only to estimate the activity of phagocytosis, but also to determine the part played by the blood cells on the one hand and the various constituents of the blood fluids (so far as these are represented by serum), on the other hand. Their method consists, as we know, essentially in finding the average number of bacteria ingested by each phagocyte in a mixture of washed blood cells, serum and bacteria, after they have been in contact for a given time at a definite temperature.

Working chiefly with cocci and tubercle bacilli, Wright and Douglas⁴, followed by Bulloch and Aitken⁵, came to the conclusion that the phagocytosis of these bacteria depended on certain substances in the serum which acted on the micro-organisms and made them a ready prey for the phagocytes; they were of opinion that the blood cells were indifferent in themselves and were uninfluenced by the substances in the serum which affected the bacteria only, and which they named "opsonins." These opsonins they found to be destroyed by exposure to a temperature of 60° to 65° C. for ten minutes, to be removed from the serum by saturation of it with the corresponding micro-organism, and to be specific. They were also found to be increased in the serum of an animal by inoculation of dead or living organisms. Dean⁶, in 1905, described some experiments which showed that the opsonins for cocci were not altogether thermolabile, and he failed to entirely inhibit their favouring influence on the phagocytosis of cocci when he heated

¹ Paper read before the Pathological Society of London on March 20th, 1906.

² *British Medical Journal*, January 11th, 1902.

³ *Proc. Royal Society*, vol. lxxii., p. 357, September 1st, 1903.

⁴ *Ibid.*, vol. lxxiii., p. 128.

⁵ *Ibid.*, January 19th, 1905.

⁶ *Ibid.*, vol. lxxvi., October, 1905, p. 506.

the sera of immunised animals. He expressed the opinion that the substances in question were no other than fixatives, and that the opsonic action was but another phase in the activities of the well-known bodies. For myself, I was unable to gather why they should not just as well be agglutinins, since agglutinins also are partially destructible by heat at 60° to 65° C., and are also absorbed by the corresponding micro-organisms.

In a series of experiments on typhoid bacteria which I shared with Leishman, Smallman and Tulloch¹, it was found that, when dealing with human serum, there was almost invariably a greater number of bacteria phagocytosed in a mixture made up with *heated* serum than in one made up with *unheated* serum; it was evident from this that heating did not destroy all the substances in serum which encourage the phagocytosis of typhoid bacilli; the apparently greater activity of the heated serum was attributed to the fact that bacteriolysis occurred in the mixtures containing unheated sera, and that, as a consequence, the phagocytes had less opportunities for exercising their functions; another possible explanation might be that the solution of the bacteria set free substances which inhibited phagocytosis. In 1905, Leishman² read a paper before the Pathological Society in which he described the action of certain thermostable substances found in immune sera which, when added in small quantities to normal blood, produced a great increase in its phagocytic activity; he also described an experiment which showed that digestion of typhoid bacteria in a serum containing these substances did not increase their susceptibility to phagocytosis, showing that the action of the substances was not on the bacteria, but, most probably, on the phagocytes; he named these substances, provisionally, "stimulins" as they appeared to him to be identical with the "stimulines" of Metschnikoff.

The following experiments have been done with a view to discovering: (1) Whether there is any opsonin for typhoid bacteria in normal or immune sera; (2) whether it is thermolabile; (3) whether opsonins are the principal or only factors in the phagocytosis of *B. typhosus* in the presence of normal or of immune sera.

Several preliminary experiments were made in order to ascertain the conditions of accuracy in phagocytosis experiments by the Wright-Douglas method. It is unnecessary to enter into details as regards these, suffice it that it was found: (1) that the degree

¹ *Journal of Hygiene*, vol. v., No. 8, July, 1905.

² *Transactions Path. Society of London*, vol. lvi., part 3, 1905.

of phagocytosis was much influenced by the temperature to which the experimental mixtures were exposed, so much so that a variation between 37° and 38° C. made, in some cases, a difference of as much as 25 per cent. in the reading; (2) that, in order to obtain even results, it was desirable to keep all the constituents of the experimental mixtures as nearly as possible at 37° C. both before and after mixing; (3) that, in reading the results, it was necessary to count the bacterial contents of not less than 50 or 60 cells, and that, if this were done, one could rely on getting readings of different films from the same experiment to within two or three decimal points of each other. Keeping these things in view, the following technique was followed: The emulsion was made with saline from a twenty-four hour agar culture; it was filtered through paper before use, and was kept in the bulb of a pipette in order to limit evaporation during use. The blood cells were washed in a half per cent. solution of citrate of soda in saline at 37° C., and afterwards twice in warm saline. The sera and emulsions were kept in the incubator at 37° C. till required. The mixtures of blood cells, serum and emulsion were incubated in a water bath at 37° C. for the requisite time, and the films, after spreading, were stained with Leishman's dye, the excess of eosin being removed, in the earlier experiments, by a 1 in 7,000 caustic soda solution and in the later ones by a 0.1 per cent. solution of methylene blue, which I found to give better results and to involve no risk of removing the whole film from the slide, as sometimes happens with the use of caustic soda. By staining in this way one gets films in which the phagocytosed bacteria are sharply defined and the view unclouded by the neutrophile granules, and, in addition, the margin of the cell is much better defined than I have found to be the case when using such stains as methylene blue, carbol-thionin or such-like.

Experiment 1.—Will the phagocytes infest typhoid bacilli in the absence of serum?

					Phagocytic index
(i.)	Washed blood corpuscles 3 vols.	14
	Normal serum	..	..	.. 3 "
	Emulsion, <i>B. typhosus</i>	..	..	.. 1 vol.
(ii.)	Washed blood corpuscles 3 vols.	1.6
	Normal saline solution	..	..	.. 3 "
	Emulsion, <i>B. typhosus</i>	..	..	.. 1 vol.

Experiment 2.—Are there any thermolabile opsonins for *B. typhosus* present in normal serum?

In order to obviate the masking effect of bacteriolysis the serum

was first saturated with an equal volume of a thick emulsion of *Staphylococcus*, the mixture was incubated for one hour at 37° C and then centrifuged. Half of the resulting clear supernatant fluid was heated to 60° C. for fifteen seconds, and the following experiment was made :—

		Phagocytic index
(i.) Washed corpuscles	3 vols. }	5.6
Normal serum saturated with <i>Staphylococcus</i>	3 „ }	
Emulsion, <i>B. typhosus</i>	1 vol. }	
(ii.) Washed corpuscles	3 vols. }	6.5
Normal serum saturated with <i>Staphylococcus</i> and then heated	3 „ }	
Emulsion, <i>B. typhosus</i>	1 vol. }	

The anticipation that saturation with *Staphylococcus* would, by removing the complement from the serum, obviate bacteriolysis, was found to be justified. The typhoid bacilli in the specimens made with unheated serum, which had been so saturated, showed no trace of bacteriolysis.

The result of the experiment shows, I think, that there are no *thermolabile* opsonins for *B. typhosus* in normal human serum.

Experiment 3.—Do the thermostable substances present in normal human serum act as opsonins for *B. typhosus*?

Normal human serum was heated to 60° for fifteen seconds; after cooling, a portion of the serum was saturated with an equal volume of an emulsion of typhoid bacilli made as thick as possible. The mixture was then incubated for one hour at 37° C., and afterwards placed for an hour or more in the electric centrifuge until the supernatant fluid was bright and clear. The control serum was diluted with an equal volume of saline, and likewise incubated and centrifuged.

The following experiments were made :—

		Phagocytic index
(i.) Washed blood corpuscles	3 vols. }	36
Heated normal serum (1—2)	3 „ }	
Emulsion, <i>B. typhosus</i>	1 vol. }	
(ii.) Washed blood corpuscles	3 vols. }	1.2
Heated normal serum saturated with <i>B. typhosus</i>	3 „ }	
Emulsion, <i>B. typhosus</i>	1 vol. }	

This result shows that in normal human serum the thermostable substances which encourage phagocytosis of typhoid bacilli are absorbed by saturation with this organism, *i.e.*, they are, in all probability, chiefly opsonins, but they differ from the opsonins for *Staphylococcus* in being thermostable. I say chiefly opsonins, because I have never succeeded in entirely inhibiting phagocytosis by saturation of a normal serum with typhoid bacilli.

Experiment 4.—Are there any thermolabile opsonins for *B. typhosus* present in immune serum?

The serum in question was my own, taken after a course of immunisation, the details of which it is not necessary to enter into at present, suffice it that the serum showed a bactericidal action towards typhoid bacilli which was about eleven times greater than normal, it agglutinated the bacilli in a moderately high dilution, and it had showed the phenomenon, described by Leishman, of markedly increasing the phagocytic activity of a mixture of normal blood cells and normal serum, when added to such a mixture in small quantities.

The serum was treated with *Staphylococcus* in the same way as in Experiment 1, and then a comparison was made between the phagocytosis produced by the resulting fluid: (a) before heating, and (b) after heating.

		Phagocytic index
(i.)	Washed blood corpuscles 3 vols.	22·36
	Immune human serum saturated with <i>Staphylococcus</i> 3 „	
	Emulsion, <i>B. typhosus</i> 1 vol.	
(ii.)	Washed blood corpuscles 3 vols.	22·14
	Immune human serum saturated with <i>Staphylococcus</i>	
	and then heated 3 „	
	Emulsion, <i>B. typhosus</i> 1 vol.	

Further evidence that the saturation with *Staphylococcus* had removed the complement and so stopped bacteriolysis was found in a control experiment in which unheated and untreated serum was used; this gave a phagocytic index of 12 as against 22 in the experiments in which serum unheated, but which had been saturated with *Staphylococcus*, was used. Another control experiment was made to see if the use of the *Staphylococcus* had in any way altered the action of the serum on the phagocytosis of typhoid bacilli; this experiment, made with heated serum which had not been exposed to the action of *Staphylococcus*, gave a phagocytic index of 21·3.

The result of the whole experiment shows that there are no *thermolabile* opsonins for typhoid bacilli in immune serum, just as we found to be the case with normal serum.

Experiment 5.—Do the thermostable substances in immune human serum, which encourage the phagocytosis of *B. typhosus*, act as opsonins?

The technique adopted was the same as in Experiment No. 3. A portion of the heated serum was saturated with an equal volume of a thick emulsion of *B. typhosus*. The mixture was incubated

for one hour at 37° C., and then centrifugalised. The control serum was correspondingly diluted with an equal volume of saline, and likewise incubated and centrifugalised.

						Phagocytic index
(i.)	Washed blood corpuscles	3 vols.	}			39.9
	Heated immune serum (1—2)	3 "				
	Emulsion, <i>B. typhosus</i>	1 vol.				
(ii.)	Washed blood corpuscles	3 vols.	}			35.4
	Heated immune serum saturated with <i>B. typhosus</i> ..	3 "				
	Emulsion, <i>B. typhosus</i>	1 vol.				

The result is quite different from that which we saw in the corresponding experiment with normal serum (Experiment 3); the thermostable substances in the immune serum which encourage the phagocytosis of *B. typhosus* are hardly diminished at all by the saturation of the serum with this organism. The major portion of them do not act as opsonins. I have repeated this experiment (as well as the others) several times, and invariably with the same result—just a very slight diminution of the phagocytic activity as a result of saturating the immune serum with typhoid bacilli. From this I would conclude that the greater portion of the work of an immune serum in the matter of phagocytosis of *B. typhosus* depends, not on an opsonic action upon the bacteria, but on a stimulating action upon the white cells. If this is so, the substances which act in this way might very justly be called "stimulins" as Leishman suggested.

CONCLUSIONS.

(1) The phagocytes of human blood are inactive towards typhoid bacilli, except in the presence of serum.

(2) Normal bloods depend, for their phagocytic activity towards typhoid bacilli, chiefly on an opsonin which differs from the opsonins for *Staphylococcus* in being thermostable.

(3) In immune human blood the phagocytosis of *B. typhosus* is chiefly encouraged by a thermostable substance, which acts not as an opsonin but probably by stimulating the white cells.

VALVULAR DISEASE OF THE HEART IN BRITISH TROOPS, NATIVE TROOPS, AND PRISONERS IN INDIA, IN THE FIVE YEARS 1895-1899, AND IN 1902 AND 1903.¹

BY LIEUTENANT-COLONEL R. R. H. MOORE.

Royal Army Medical Corps.

It was in the year 1897 that my attention was first drawn to the fact that British troops in India suffer to a much larger extent from valvular disease of the heart than natives of the country, whether soldiers, or civilians, as represented by the prisoners in the Indian jails. How to account for this puzzled me a good deal at that time, and has continued to puzzle me more or less ever since. It therefore occurred to me that it would be a good thing to bring the subject before you, in the hope that a discussion may throw more light upon the matter. The statistics that I bring forward are taken from the Annual Reports of the Sanitary Commissioner with the Government of India. For my comparison I have taken the five years 1895 to 1899, and the years 1902 and 1903, which are the last two years available. The following small table contains all the necessary figures:—

TABLE I.—ADMISSIONS, DEATHS, AND INVALIDS PER 1,000 AMONGST BRITISH TROOPS, NATIVE TROOPS, AND PRISONERS IN INDIA.

Year	BRITISH TROOPS				NATIVE TROOPS				PRISONERS		
	Average strength	Per 1,000			Average strength	Per 1,000			Average strength	Per 1,000	
		Admis- sions	Deaths	Invalids		Admis- sions	Deaths	Invalids		Admis- sions	Deaths
1895 to 1899	69,068	2·36	0·16	1·20	128,461	0·39	0·08	0·13	111,178	0·95	0·24
1902	60,540	3·86	0·59	2·08	124,231	0·44	0·13	0·16	114,834	0·94	0·29
1903	70,445	3·71	0·29	1·50	124,660	0·19	0·07	0·11	101,717	0·62	0·21
Average of 1902 and 1903	65,292	3·78	0·44	1·79	124,445	0·31	0·10	0·13	108,025	0·78	0·25

Taking the figures that represent the average admission rates for the five years 1895-1899, and comparing British with native troops, we find that the former's admission rate is six times as high, their death rate twice as high, and their invaliding rate nine

¹ A paper read before the Aldershot Military Medical Society.

times as high. Compared with the prisoners, their admission rate is two and a-half times as high, while their death rate is a good deal lower. Now, taking the figures that represent the two years 1902 and 1903, we find that, instead of improving, things are getting worse; the admission rate for British troops is ten and a-half times as high, the death rate four and a-half times as high, and the invaliding rate fourteen times as high as it is for native troops. Compared with prisoners, their admission rate is 4·8 times as much, and their death rate a little under twice as much. For some unexplained reason, the year 1902 is the highest of all the years considered in almost every particular. The difference between the admission rates and the invaliding rates of British and native troops is certainly remarkable; it becomes still more so when we consider the fact that the British troops have undergone a considerable weeding out before going to India, while the figures include every native soldier from the time he has been passed as a recruit.

I cannot tell you how many British soldiers are invalided in their first year for heart disease, but I can tell you that diseases of the heart cause more invaliding in the Home Army than diseases of any other organ. In the Army Medical Department Report for 1903 is the following statement, "As usual, the largest number of invalids come under heart diseases." Again, the invaliding during the first two years of a man's service is very heavy; 23·35 per 1,000 are shown as invalided during the first year, and 30·19 per 1,000 during the second year, in the Army Medical Department Report for the year 1903. The numerous medical examinations that the British soldier has to undergo, including the final one as to fitness for foreign service, makes it almost impossible that a man with any affection of the heart can embark for India. It is the first year of barrack life that is the most trying for the soldier. French Army statistics have proved that during this year the recruit suffers from almost all diseases to a much greater extent than his brethren in civil life. If this is true, I think there can be no doubt that, if the figures in the table I have put before you included all the British soldiers that were admitted and invalided during their first and second years of service, the disparity between them and the native troops would be even more marked than it appears to be.

It will, I think, be of interest now to give you the figures for disordered action of the heart, for a single year only, both for British and native troops, just to give you an idea to what an extent this affection also preponderates amongst the former. In

the year 1902, the admission rate was 9·05 and the invaliding rate 2·28 for British troops, while the figures for native troops were 0·36 and 0·05 respectively. British troops therefore had twenty-five times as many admissions and 45·6 times as many invalids.

It was my intention to confine myself entirely to valvular disease of the heart, but incidentally this other question has cropped up. Therefore, to be quite clear, there are two issues before you: one, the disproportionate extent to which British troops suffer from disordered action of the heart; the other, the extremely high admission and invaliding rates for valvular disease of the heart. My principal object is to throw some light upon the latter. Where, then, are we to seek for some acceptable explanation of it?

I see that Captain J. McD. McCarthy, R.A.M.C., in a short paper on disordered action of the heart in soldiers, in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for last November, mentions as causes: (1) The effects of malarial and other fevers, (2) alcohol, (3) climate, (4) over-exertion when not in condition. I also have drawn up a number of headings, some of which may suggest the underlying causes of what seem to be a very serious process of physical deterioration. My headings are: (1) Racial susceptibility, (2) climate, (3) artificial conditions of Indian life, (4) habits, (5) clothing, (6) food, (7) the special duties of the soldier, (8) homesickness, (9) malingering, or purposely inducing disease. I will not bore you by dilating on these points *seriatim*. I see no reason to think that as a race we are more susceptible to diseases of the heart than the natives of India; on the other hand, it is not easy to prove that we are not. Racial susceptibility to disease is no doubt an interesting subject, and would provide plenty of matter for discussion, but I do not think it has been sufficiently studied as yet to enable us to draw any settled conclusions from it. I myself doubt if there is such a thing as natural race immunity to any disease. India, curiously enough, provides us with two apparent instances of it: plague, which is annually killing thousands of natives, while Europeans almost entirely escape, and enteric fever, which acts in the opposite way, carrying off the Europeans and letting the natives alone. The immunity which Europeans enjoy with reference to plague is, to my mind, accidental, not natural. In the great majority of cases plague enters the body through abrasions of the feet or hands; in women, axillary buboes preponderate, as they use their hands more about their houses, preparing food, cleaning up, and especially in keeping their floors in order. Europeans are not exposed to these means of

infection, and again, they do not live in the places where plague thrives. In a word, they are protected by their habits and by their clothes. They are, in fact, immune to plague in the same way that they are immune to snake bite; they are not equally exposed to it.

With respect to enteric fever. It has been maintained for years by medical men in India that natives are immune to enteric fever. But there is nothing that can be taken as proof that this is really the case. Of late years an increasingly large number of undoubted cases have been reported in natives of all classes. In the Native Army the number of cases returned is very small.

How is it that the disease, if present, is unrecognised?

The explanation I would offer is that the native has acquired a large degree of immunity to enteric, as we have to measles and scarlet fever, that the disease occurs in him in a mild and modified form, and that it is hardly ever fatal. Amidst the tangle of Indian fevers such a form would be certain to be overlooked, and nothing but a systematic application of Widal's test to every case of fever in the Indian Army will elucidate the problem. At present the strongest argument that the Sanitary Commissioner with the Government of India finds to buttress up his already somewhat shaken faith in the immunity of the native to enteric is based on the wholly untenable and quite unscientific assumption that the case mortality in natives must be the same as in Europeans. Now, I maintain that if the native has any immunity it is an acquired immunity, and that an acquired immunity would first show its presence in a milder form of the disease, and therefore in a lowered case mortality. But we find that this is not the case. The case mortality from enteric is larger amongst native troops than amongst British troops. In the year 1903 the case mortality for British troops was 21·3 per cent., while for native troops it was 33·7 per cent. This case mortality, taken alone, is, I hold, sufficient to prove that a large amount of enteric fever is unrecognised amongst native troops in India. In other words, the ordinary mild attacks pass unrecognised, and only the exceptionally severe cases are diagnosed.

I fear I have wandered away from the subject before us, but the temptation to get away for a minute from the dry region of hard figures to the fascinating byways of speculation must be my excuse. But to return.

I have nothing more to say under the above headings, because I feel that the figures, as they stand, are too formidable to be attacked by such light skirmishers. I will attack them in another way. I will first undermine them, and show that things are not

what they seem; that a lot of this valvular disease of the heart amongst British troops does not exist; that a lot of it, in fact, is due to erroneous diagnosis. Most of us will admit that a man who has valvular disease of the heart will never be fit to serve as a soldier again.

Well, according to the Army Medical Department Report for 1902, 126 men were invalided from India for valvular disease of the heart, and of these 30 were sent back to duty. In 1903, 106 were invalided, and of these 17 were sent back to duty. Therefore, in 1902, 23·8 per cent. of the cases invalided probably never had valvular disease of the heart at all, and 16 per cent. of the 1903 invalids can be accounted for in the same way. The remainder of the invalids were discharged the service; but this cannot be taken as proving that they were all actually suffering from organic heart disease. We can also estimate the probable errors of diagnosis in other ways. In the five years quoted there were 818 admissions; of these 58 died, and 415 were invalided. What happened to the remaining 345? They must have returned to duty. Are we prepared to admit that all these were cases of recovery from valvular disease of the heart? Is it not more likely that the great majority were cases of erroneous diagnosis? (Some allowance must, of course, be made in the admission figures for cases of multiple admission).

Again, true heart disease is a serious ailment, and we naturally expect that the deaths will bear a fairly high proportion to the admissions. Well, for these five years how many of the cases admitted for valvular disease of the heart died within the year? The percentages are, for British troops, 7·09 per cent.; for native troops, 20·6 per cent.; and for prisoners, 27·1 per cent. It is, of course, to be expected that the figures for prisoners should be the highest, as there is no such thing as invaliding for them. Their figures may, therefore, be taken as a very fair standard of what we might expect the case mortality to be. On the other hand, the figures for British and native troops may be very fairly compared, as they are both subject to the same conditions of invaliding and there is nothing to show that valvular disease of the heart is not equally fatal to both. The case mortality for British troops is roughly one third of that for native troops, 7·09 per cent. to 20·6 per cent. There were in the five years 818 British admissions with 58 deaths, and 252 native admissions with 52 deaths. If the death rate were the same there would have been 281 British admissions to produce 58 deaths. But there were 818. The remaining 537, about two-thirds, is our approximate error of diagnosis.

I can hardly expect that you will be prepared to admit off hand,

even for India, that two-thirds of the cases admitted to our hospitals for valvular disease of the heart are wrongly diagnosed, and are really not cases of valvular disease of the heart at all. Well, I do not deny the difficulty, nay, I may even say the impossibility, of arriving at accurate conclusions on this point from the figures before us. Neither do I wish to be understood as assuming that the diagnosis in the case of native troops and prisoners is, in all cases, to be relied on. I use the figures merely as a convenient comparative test. But still, every allowance being made, we must admit that the figures for British troops are out of all proportion—that they are, in fact, outrageously high. It remains for us to consider how this comes about. We all, and very rightly, look upon valvular disease in the soldier as a very serious thing, a disease that at once unfits him for all further duty.

Many civilians who are known by their medical advisers to be suffering from pronounced forms of heart disease are permitted to follow their ordinary employments; they frequently have no choice in the matter.

With soldiers it is different. Once a man is known to have developed valvular disease of the heart no medical officer will take upon himself the responsibility of allowing him to do another days' work. There is no one to blame the civil practitioner if his patient drops down dead at his work, or in the street, but with the medical officer in the army it is different; for him it might be a very serious thing.

In cases of real valvular disease of the heart this is quite right, but what is taken as the criterion of valvular disease of the heart—the *presence of a bruit*? In the Service a bruit is synonymous with valvular disease. This is the crux of the whole matter, and explains away the greater part of the excessive amount of valvular disease in the army. If a medical officer, with a reputation for doing his duty carefully, sends a man to hospital marked valvular disease of the heart, that man runs a good chance of being invalided from India, even though the bruit may never be heard by anyone else, nor, indeed, ever heard on a second occasion. I have seen it happen. A man was sent from an out-station to appear before a Board for valvular disease of the heart. None of the Board could hear a bruit. They summoned three other medical officers who were in the hospital; none of these officers could hear anything; but for all that the man was sent home.

Some bruits are, as we all know, transient. Well, from my experience in the Service, the working rule is, once a bruit, always a bruit. I have seen officers searching day after day for these

fugitive bruits until they found them, and, having found them, like Captain Cuttle, they made a note of them, and the man went before the next invaliding Board.

I once served at a station with an officer who had a perfect genius for finding these bruits. If he had a class of a hundred men to examine for gymnastics, he could be relied upon to send five or six to hospital marked valvular disease of the heart, with perhaps in some cases a query after the entry. I have known men of five or six years' service, who had never been in hospital, and never made any complaint of any illness, picked out in this way, and invalided home for transient bruit which never disturbed the regular action of their hearts.

You may be inclined to say that my experience has been exceptional. I thought so at the time myself, but going over the statistics again, and more especially taking into consideration the fact that I have demonstrated to you that the invaliding for heart disease is on the increase, instead of diminishing, I am beginning to believe that it is not so. If, however, my experience is exceptional, and not to be relied upon for general deductions, how do you explain the figures I have put before you? An officer very naturally hesitates to send a man back to duty if another officer has marked him valvular disease of the heart. The figures, however, show that it must often be done, and I have done it in some cases myself where the men had been in hospital under observation for some time, where the bruit was transient, and where the heart's action was regular, and no bad results followed. I do not set up to know more about heart disease than any one else, be he who he may, but I think it is fair common-sense to say that if at any time a man's heart is free from all trace of a bruit, and acting regularly, that that heart is free from disease. From what I have seen there appear to be many who take the opposite view, namely, that if at any time a bruit can be heard, that bruit, though perhaps heard only on one occasion, is proof positive of the existence of valvular disease of the heart.

In the *Lancet* of July 7th, 1905, there is a lecture on "Diseases of the Heart," by James F. Goodhart, M.D., LL.D.Aberd., F.R.C.P. Lond., which is well worthy of perusal in this connection. He says: "If you make a practice of examining the heart of every one you see for the first time, no matter what the complaint, both standing up and lying down, I am sure that the frequency with which you will find this systolic, or these systolic bruits, will surprise you." Again he says: "What, however, is, I think, not even yet so well known as it ought to be, or allowed for in daily

practice, is the frequency with which they occur even in healthy subjects." Further: "But I am concerned to insist that a portion of them" he is referring to systolic murmurs "are produced at the mitral orifice; and that any of them may occur in man, woman, boy or girl examined, it may be casually, and in whom there need be no sign of any disease or even of disturbance of the action of the heart."

Another very interesting paper on this subject appeared in the *Lancet* of November 13th, 1897, on "Irritable Heart and Transient Murmurs as a Cause of Rejection of Candidates for the Army and Public Services," by Sir William Broadbent. He says: "A more common cause of rejection is the presence of a murmur which may be perfectly innocent of significance. Such murmurs may simulate closely a soft systolic mitral, but are heard only during inspiration or when the chest is full, and are due to compression of the overlapping lung by the heart during systole. Pulmonary murmurs may depend on bulging of the conus arteriosus against the chest wall; they disappear when the lung is interposed on deep inspiration. Sometimes bruits are heard, not only in the course of the ordinary mitral regurgitant, but over the greater part of the lung. In such cases there is usually pleural adhesion. . . . The criterion of pseudo-mitral disease is absence of displacement of the apex beat and of accentuation of the pulmonary second sound, or undue right ventricular impulse, together with absence of symptoms. Other murmurs are heard in the tricuspid area which are perfectly harmless, and such tricuspid bruits are rarely constant."

Sir William Broadbent here gives us some assistance in making a diagnosis between these transient murmurs and actual organic disease of the heart. Neither of these authors, be it observed, lays it down that it is an easy matter to discriminate off-hand between the serious lesion and the innocent bruit. In all these cases it is necessary to take precautions and to keep the case under observation. That is, however, exactly what we are able to do in the army; we can keep these cases under observation as long as we like.

A practical suggestion occurs to me that it would be a good thing if no cases were sent to hospital diagnosed in the first place—that is, after a single examination—valvular disease of the heart, and that they should not be so diagnosed in hospital until there was no doubt about the matter. I think that if this were done, and if the innocence of many of these bruits was constantly borne in mind, we should have fewer cases of valvular disease of the heart in our returns.

INCONTINENCE OF URINE IN THE SOLDIER.

BY LIEUTENANT-COLONEL S. GLENN ALLEN.

Royal Army Medical Corps.

ALTHOUGH, relatively speaking, the number of admissions for the morbid condition, generally called "incontinence of urine," may not be great, nevertheless, there are few medical officers who do not meet with cases at an early stage of their military career, and fewer still who do not later come to look upon it as one of the most puzzling, as regards causation, of all the "minor ailments" of the soldier. It is also soon recognised as being a complaint in which treatment avails little, and consequently becomes responsible for the invaliding out of the Service of most of those affected. These facts alone make the disease one of importance to all of us. But there is another point which lends special importance to it from the point of view of the recruiting medical officer, namely, the fact that the weakness is so often detected in the young soldier, who will be found to have suffered from it long prior to enlistment.

Within the last few months I have come across one or two cases diagnosed "incontinence of urine," which have suggested to me that the morbid condition underlying the symptoms is often quite different to what one has hitherto supposed. It is principally with the view of bringing this fact to the notice of the readers of our Journal, and of enlisting assistance in the further investigation of the matter, that I have written this short paper. The importance, however, of excluding men from the Service who have ever been subject to nocturnal incontinence is so obvious, that I should like to say a few words first on this subject, from the point of view of the recruiting medical officer.

There being no physical signs by which the existence of the disability can be recognised at the medical examination of recruits, it appears to me highly desirable to place "incontinence" in the same category as "fits," and enjoin the examining officer (by regulations) to enquire whether the recruit has at any time suffered from "weakness of the bladder," and to reject all who fail to give a satisfactory assurance on this point.

As those who are fortunate enough to be appointed as recruiting medical officers at the large recruit

and malingering, being the principal ones given. The first three causes are no doubt at the bottom of a few cases. The fourth cannot be counted as a cause at all, being only a roundabout confession of ignorance. As regards "malingering," I confess I am sceptical as to any case being due to it. I regard "malingering," as quite an uncommon (moral) complaint among soldiers; so much so indeed that if I were permitted to give a word of advice to young officers of the Royal Army Medical Corps, just entering the Service, on this point, I should certainly say, "If a soldier complains of any symptoms for which you are unable to find a cause, regard "malingering" as the *most unlikely* of all explanations, which, by the way, is almost the exact opposite to the teaching I received from most of my seniors when I entered the Service.

Towards the end of the year 1903, being then in charge of the medical divisions of a large military hospital, I met with a case diagnosed "incontinence of urine" which first suggested to my mind that the "cause" of many such cases might be quite different to what has hitherto been supposed. This particular patient had been about two months under treatment for supposed "incontinence," and was specially brought to my notice with the view of invaliding him, as he had not improved at all in hospital. There were, however, one or two points about his case which seemed to me to differentiate it from those one had been accustomed to meet with in young soldiers. For example—the man (who was a Gunner of the Royal Field Artillery) had over ten years' service; the complaint had only appeared during the last few months, and he had never suffered in this way prior to enlistment. Earlier in the year he had been invalided home from India on account of enteric fever, and the existence of some connection between that disease and his present disability seemed probable. At any rate, these facts led me to make an independent investigation of his case; the result being to satisfy me that his symptoms had been all through of renal origin; in fact, that he was suffering from well-marked "polyuria," and that the bladder was perfectly healthy and the sphincter fully under control. The urine was measured daily for some time, and examined very carefully and repeatedly, so as to exclude the possibility of true diabetes or chronic Bright's disease, and the diagnosis of "simple polyuria" (Diabetes insipidus) established; this being evidently a case of "irritative polyuria," due to the toxæmia of enteric fever, and having no connection with "incontinence." Since then I have

made a practice of measuring the daily excretion of urine in all patients sent to hospital for "incontinence" which have come under my notice, the result being that two more cases of a similar kind have, up to the present, come under my own observation. The last of these came into hospital only last month (August, 1904), when I was once more in temporary charge of the same division. This man was a young infantry soldier (fifteen months' service), and had been transferred from another station for treatment on account of alleged "incontinence of urine." The daily secretion, in this case, varied between 70 and 110 ounces. This man admitted to having been subject to this "weakness" from boyhood, but as no question was asked at the medical examination, he (naturally enough) volunteered no information on the subject.

I am quite aware that the cases I have had the opportunity of investigating since the matter first engaged my attention are too few in number to draw any definite conclusions from, so I only venture to suggest that many cases supposed to be examples of "incontinence of urine" (due to some inexplicable lack of control over the sphincter vesicæ during sleep), are really cases of "polyuria," following some acute specific disease from which the patient has suffered, possibly in childhood.

If all officers who come across men suffering from "nocturnal incontinence" will have the total amount of urine passed each day (twenty-four hours) carefully measured, the correctness or incorrectness of the explanation I here offer will soon be established. If any of my brother officers will further be so kind as to inform me of the result of their investigations, I shall be much indebted to them.

There is not much difficulty in understanding how the error of diagnosis arises in these cases. It is a remarkable thing how a soldier, when reporting sick, will give (without any intention of misleading the medical officer) quite undue prominence to some quite subsidiary symptoms of his complaint while omitting all mention of its most striking and important features. All three of these patients when asked what symptoms they suffered from, replied "inability to hold their water at night, owing to weakness of the bladder." As a matter of fact they cannot, any of them, have failed to have noted the great increase in the amount of urine passed, both day and night, obliging them, in the latter instance, to get up two or three times to empty the bladder. That urine was sometimes passed in bed was no doubt also the case, but this only

occurred after the "polyuria" had been in existence for some length of time, and was occasional and accidental, or perhaps was done more or less voluntarily to avoid the break of rest incurred by leaving their beds to pass water. It is only another illustration of the well-known medical fact, that the statements of a patient regarding his own symptoms cannot be relied upon without submitting them first to careful cross-examination.

Treatment, &c.—As regards the treatment and prognosis in these cases, I have, at present, little to say. Accurate diagnosis, however, of the morbid conditions underlying and giving rise to the symptoms of disease being the first step necessary towards scientific and successful treatment, once the former has been arrived at in cases of true (or so-called) "incontinence of urine," the latter may be expected to follow.

KALA-AZAR.

BY LIEUTENANT-COLONEL C. BIRT AND CAPTAIN H. R. BATEMAN.

Royal Army Medical Corps.

"KALA-AZAR has for a number of years been one of the riddles of tropical medicine. There have probably been few diseases so frequently investigated during so short a period in which such varying conclusions have been arrived at by those who have been occupied with the work of investigation. In 1890 Giles¹ declared the disease to be the result of ankylostomiasis, either by itself or, in some cases, complicated with a coincident malarial infection. A few years later Rogers² was equally emphatic in his repudiation of the ankylostomal theory of origin. He states, after a lengthy discussion of the whole question, 'the disease, then, is a very intense form of malarial fever.' Still more recently, Ross³ in his exhaustive and interesting 'Report upon the Nature of Kala-azar,' appears to insist on the non-malarial nature of the second stage of the disease. It is true that he states—'I think, then, with Rogers, that kala-azar is malarial fever,' but this statement is so qualified in the text that he is generally quoted as ascribing the condition to a peculiar form of post-malarial cachexia. Thus Manson in his work on 'Tropical Diseases' says: 'Ross . . . considers that kala-azar and a similar condition called kala-dunkh are virtually forms of post-malarial cachexia, akin to, if not identical with, similar conditions met with elsewhere in malarial countries!'"

This quotation is the prologue of a comprehensive paper by Bentley,⁴ published in the *British Medical Journal*, September 20th, 1902, based on an experience of 400 cases, the burden of which lay in its conclusion: "Evidently, whatever else it may be, kala-azar is essentially Malta fever."

¹ Giles, G. M., I.M.S., "A Report on an Investigation into the Causes of the Diseases known in Assam as Kala-azar and Beri-beri." 1890, pp. 156. Shillong: Assam Secretarial Press, 1890.

² Rogers, L., I.M.S., "Report of Investigation of the Epidemic of Malarial Fever in Assam, or Kala-azar." Pp. 223, with two appendices. Assam Secretarial Printing Office, 1897.

³ Ross, Ronald, I.M.S., "Report on the Nature of Kala-azar." Pp. 87. Calcutta, 1900.

⁴ Bentley, C. A., M.B., "Kala-azar as an Analogous Disease to Malta Fever." *British Medical Journal*, vol. ii., 1902, p. 872.

This proves that darkness, truly Cimmerian, enveloped the origin of this fatal malady. The keenest scientific intelligences in India had been baffled in their efforts to dispel it. Leishman discovered his famous bodies in the spleen of a fatal case, and all became clear.

Kala-azar is an infection characterised by chronic fever, emaciation, although the appetite is often voracious, progressive weakness with muscular atrophy, petechiæ and pigmentation of the skin, greatly enlarged spleen with variations in its size, anæmia, diminution of leucocytes with relative increase of mononuclears, absence of malarial parasites, presence of Leishman bodies in blood obtained by splenic or liver puncture, hæmorrhages, and œdema of the ankles, — fatal ending by secondary invasion of dysentery organisms, pneumococci, *cancrum oris*.

The malady causes a heavy mortality among the natives of certain parts of India. Some regions are devastated through its ravages. Fortunately, it is infrequent among British troops.

Leishman¹ made his memorable discovery in November, 1900, when he showed the bodies in a stained film of the spleen to one of us (Birt) on the day he obtained them. He refrained from publishing a report of his observations until he could confirm his results. Lack of material caused a delay for two and a half years. The clue of the mystery was given. Zealous physicians and pathologists in the endemic areas eagerly followed it up among the multitude of sufferers under their care and filled in details. The result of their investigations has been that kala-azar is invariably associated with the Leishman body. The account of the following case, although it contains few new points, harmonises with the composite picture of the disease portrayed in the increasing literature of the subject.

Lance-Corporal C. was stationed at Dinapore, which McKenzie² has shown to be an endemic area. He moved to Lucknow, where no cases had hitherto been noted. Four months later he developed his illness. His past history otherwise threw no light on the origin of the disease. He had resided in India eight years and had led a steady life. He had been exempt from malarial fever, but it is well-known that malarial immunity affords no safeguard against kala-azar. Evidence is accumulating that blood-suckers

¹ Leishman, W. B., R.A.M.C., *British Medical Journal*, vol. i., 1903, p. 1252.

² McKenzie, J. C., R.A.M.C., *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS*, February, 1906, vol. vi., p. 163.

are the probable intermediaries in the conveyance of the infection, but he was not aware that he had been attacked by ticks or leeches, nor by bugs, fleas or mosquitoes in an exceptional degree. Rogers¹ states that kala-azar frequently attacks more than one member of a family. Bentley² gives an instance of the communicability of the disease to five people in succession. Each was employed in nursing the previous case. The statements of Lance-Corporal C. afforded no indication of this mode of origin. The incubation period of kala-azar is unknown. After leaving an infected district he had been in Lucknow four months before the onset. In his case this would imply a minimum incubation period of that time.

Bentley states the symptoms at the commencement suddenly arise with a rigor, high fever and vomiting. Lance-Corporal C.'s onset was insidious. His earliest complaints were lassitude and anorexia, followed by great and unwonted thirst day and night, severe nocturnal headaches, and increasing sallowness of complexion which was noticed both by himself and his comrades. Notwithstanding the above, he contrived to do his duty for three months. After one month in hospital his liver was explored on the supposition that the continuous fever which had been observed might be due to liver abscess. The negative result called for a splenic puncture, which disclosed the nature of his ailment in the discovery of Leishman bodies. These underwent multiplication and enlargement *in vitro*. Dysentery and œdema of the ankles supervened. The liver and spleen greatly increased in size. Pigmentation of the skin and loss of weight were progressive, though his appetite had become voracious. He arrived in England seven months after his illness began, and came under our observation thirteen days before his death. He had become very anæmic, emaciated and sallow. He complained of great hunger and thirst. His skin was lemon-tinted, lax, and inelastic. The pigmentation which had been noted in India had disappeared, except at the sites of the exploratory punctures. There were no subcutaneous hæmorrhage, ulcers or œdema. His tongue was dry, glazed, flabby, tooth-indented, and slightly furred behind. He passed three to eight evacuations a day of a greyish-brown grumous matter. Neither *Ankylostoma ova* nor Leishman bodies were seen. Though there was extensive chronic dysenteric ulceration present, neither

¹ Rogers, L., I.M.S., *British Medical Journal*, vol. ii., 1904.

² Bentley, C. A., M.B., Tezpur, Assam. *British Medical Journal*, vol. ii., 1904, p. 655.

blood, mucus, nor amœbæ were noted in the dejecta. There was no tenderness along the course of the colon. Beyond accentuation of the pulmonary second sound there were no abnormal cardiac physical signs. His blood count was 3,000,000 red cells, and 2,700 white cells per cubic millimetre. Hence leucopenia was pronounced. This is one of the most important diagnostic signs of the disease.

Rogers¹ states that the leucocytes are reduced to less than 2,000 in the majority of instances. In one of his cases they fell to 60 per cubic millimetre.

The differential count gave: polynuclears 64 per cent.; large mononuclears 14 per cent.; small mononuclears 19 per cent.; transitionals 3 per cent.; eosinophiles and masts 0.

Rogers comments on the extraordinary reduction of polynuclears as being a remarkable feature of the disease. His counts mostly range from 5 to 50 per cent. only. Although Lance-Corporal C.'s polynuclears were not relatively decreased, yet he had a great reduction—1,700 instead of the normal 5,600 per cubic millimetre. In common with other protozoal diseases the ratio of the large mononuclears was raised 14 per cent. instead of the normal 2 to 4 per cent. Each leucocyte was examined carefully for Leishman bodies. In one polynuclear only was a single individual observed. Hæmamoebæ were absent from the red blood cells. Serum reactions in ten-fold dilutions with *Micrococcus melitensis* and Shiga's dysentery bacillus were negative. The splenic dulness reached the seventh space in mid-axillary line. The lower border of the viscus could be felt three inches below the costal arch. He was subject to no pain or tenderness, even on deep pressure over the organ. He states that its size was variable. This fact has been noted in previous records. The liver was not enlarged in size or tender. Leishman bodies were obtained by liver puncture, and were observed to undergo development into flagellates in sodium citrate solution by Professor Leishman. His urine was normal. No parasites were observed in the small amount of deposit obtained by the centrifuge. There was no hypertrophy of any of the lymph glands. There were, however, no signs of ulceration of the skin. Christophers² has found the organisms in the glands which drain the area in which a skin lesion has existed. He had evidence of severe bronchitis. No specific bodies were discovered in the

¹ Rogers, L., I.M.S., *British Medical Journal*, vol i., 1905, p. 705.

² Christophers, S. R., I.M.S., "Scientific Memoirs by Officers." Government of India: No. 11, 1904.

sputum. Eight days before death his temperature, which had ranged between 98° F. and 100° F., suddenly mounted to 101° F. and 102° F. Signs of pneumonia, from which he died, came on, complicated with severe paroxysms of air-hunger. His stools, which had been almost inodorous, became very offensive. A copious hæmorrhage from the large intestine took place. Persistent hiccough and vomiting were noted four days before death, though his desire for food was not impaired thereby. His demands for solid food were urgent up to two days of his decease. The duration of his illness was nine months. Bentley states attacks may last for several years, or run through a rapid course of a few months. The dysenteric form is usually rapidly fatal. Quinine, red bone marrow, arsenic and iron were given without benefit.

The diagnosis of kala-azar is not often made during its earliest stages. The disease may be confounded with enteric, malarial, Mediterranean, or chronic pyæmic fevers; dysentery and liver abscess commonly; tubercle, pernicious anæmia or leukæmia less frequently. The most important sign, next to the actual demonstration of the parasite, is the presence of leucopenia. But leucopenia may occur in enteric fever in which a leucocyte count under 4,000 is not uncommon during the third and fourth weeks, and also in acute tuberculosis. In those instances of enteric fever in which the serum reaction is negative in high dilutions, errors may arise. In cases of doubt an attempt to isolate the infecting micro-organism from the patient's blood should be made. Moreover, in enteric the rule obtains that there is an increase in the percentage of lymphocytes without an increase of the large mononuclears. Malaria would be probably excluded by absence of hæmamoebæ in the blood on repeated examination and its amenability to quinine. Mediterranean fever will be recognised by the agglutinating reaction of the blood on a recently isolated culture of *M. melitensis*. Chronic pyæmic fevers and liver abscess are accompanied with leucocytosis. In uncomplicated dysentery there is no enlargement of the spleen. Examinations of stained blood films in pernicious anæmia and leukæmia will decide the nature of the disease. In those acute tubercular infections in which tubercle bacilli are not expelled with the sputum, &c., absence of a marked leucopenia should aid in making the diagnosis.

Rogers is of opinion that a double rise occurring in the temperature curve in the twenty-four hours, seen in the four-hourly chart, is characteristic of kala-azar. This peculiarity is not limited to that disease; four-hourly Mediterranean fever charts may also show it.

On *post-mortem* examination, twelve hours after death, emaciation was extreme. No ulcers, except a small bed sore over sacrum, hæmorrhages or œdema were noted. The immediate cause of death was found to be lobar pneumonia of the right lung, due to a general infection with Fränkel's pneumococcus. That organism was cultivated from his lung, liver and spleen. There were no effusions into any of the serous cavities. Ascites has been frequently observed in kala-azar. The spleen weighed thirty-one ounces; it was deeply red, moderately firm, but unlike the dark, slate-tinted, consistent "ague-cake" of malaria. Smears of splenic-pulp contained innumerable Leishman bodies. These are slightly oval structures, 2 to 4 μ in length. They contain a macro-nucleus, which stains violet-red with Leishman's dye, and a micro-nucleus, which appears as an almost black dot or tiny rod. The cytoplasm is faint blue in satisfactory preparations, but is not always evident. Löffler's methylene-blue and hæmatoxylin stain them, but with gentian-violet or carbol-fuchsin, on account of the diffuse colouration, they cannot be demonstrated with certainty. They are Gram-positive, and not acid-fast. In sections of the spleen treated with Leishman's dye, Löffler's methylene-blue, and van Gieson's stain the specific bodies were seen to be intracellular; none were free, nor were they found in the red blood corpuscles. The endothelial cells contained them in greatest abundance, though the splenic cells themselves were also invaded. The small necrotic areas noticed by Marchand and Ledingham¹ were well brought out in sections stained with Löffler's methylene-blue. The red reaction of waxy degeneration with methyl-violet was absent. There was no pigment observable. The liver was greatly altered on naked-eye examination; it was not enlarged, the weight being fifty-four ounces. Its general colour was much lighter than in health, due to a fine yellow mottling of its surface. The capsule was not thickened. The organ was more friable than usual. Numerous Leishman bodies were present in smears. Sections showed that they were contained, for the most part, in the endothelial cells, though some were lying in masses of cytoplasm devoid of nuclei. They were also numerous in the liver cells proper. The lumen of the capillaries was increased in size. There was fatty degeneration and atrophy of the liver cells, the nuclei of which were often broken up into mulberry-like masses. There was no deposit of pigment.

¹ Marchand and Ledingham, C. L., *Zeitschrift für Hygiene und Infektionskrankheiten*, 1904, p. 1.

The bile was clear and sterile; no parasites were discovered. The kidneys were pale, but, microscopically, normal, except that Leishman bodies were present in a few endothelial cells. The lower three feet of the small and the whole of the large intestines were much thickened and presented the usual appearances of chronic dysenteric ulceration. There was a wash-leather-like film in the interior of the affected part of the small gut, similar to that seen in some cases of Shiga's dysentery. The large bowel, which scaled twice the normal weight, was much narrowed at the sigmoid flexure from the dysenteric infiltration of its coats. There were ulcers, some deep, throughout. No Leishman bodies could be discovered on examination of numerous scrapings from the ulcers and affected areas of both large and small intestines. In one section of the large intestine two parasites were found in the submucous coat. Amœbæ were not seen. There was no indication that this extensive ulceration was due to the splenic parasites. Christophers¹ has, however, recorded instances in which they were the main agents in the intestinal complication of kala-azar.

Leishman bodies were found in the cells of the marrow of the femur, which had become pinkish in colour.

The plates accompanying Statham's² paper give a faithful representation of what we found in our sections of the organs.

Nothing of interest was observed in the other viscera.

We are greatly indebted to Lieutenant-Colonel R. J. S. Simpson, C.M.G., for his kind permission to examine Lance-Corporal C., and for the use of the clinical notes of the case.

¹ Christophers, S. R., I.M.S., "Scientific Memoirs of Officers." Government of India, No. 8.

² Statham, J. C. B., R.A.M.C., JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, September, 1905, vol. v., pp. 366-384.

REMARKS ON THE HISTORY AND PREVALENCE OF DIPHTHERIA IN THE BRITISH ARMY.

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THE early records of military medicine are rather meagre, and it is therefore difficult to obtain much information as to the prevalence of throat disease of a diphtherial character among the troops before the issue of the Army Medical Reports was commenced in 1859.

Dr. John Pringle, in the fifth, or 1765, edition of his book on "Diseases of the Army," makes a casual allusion to "angina maligna, or ulcerous sore throat," under the head of treatment. His civil contemporaries describe a malignant ulcerous sore throat, which was no doubt diphtheria, and some of them mention him in connection with the literature of the subject; it may therefore be inferred that the disease was not unknown among the troops in the eighteenth century.

William Rowley, of London, was "in His Majesty's Service from the year 1760 to 1764, in the war against France and Spain." His work, "Medical Advice to the Army and Navy," contains directions for the treatment of ulcerous sore throat. He wrote also an essay on the "fatal effects in 1787" of the malignant ulcerated sore throat. It is clear from his description that the disease was diphtheria, but he does not say whether the "fatal effects" extended to the troops.

Dr. J. Johnstone, of Worcester, writing in 1778, apparently thought that the troops were instrumental in spreading the malady. After tracing its progress from Egypt, through Syria, to the Greek Archipelago, Italy, Sicily and Spain, he says it "appears to have been spread by the Spaniards through all the rest of Europe. It broke out and raged with the greatest fury, both in France and this Island, soon after the beginning of the Spanish War. Thus contagion evidently appears to be the uniform and constant occasional cause of this disorder."

Though it is evident from the above that diphtheria was common enough during the latter part of the eighteenth century, and therefore was likely to have affected the troops more or less, it is doubtful if the disease was at all frequent among soldiers, and it was certainly not very fatal in the beginning of the nineteenth

century. In a report on sickness of troops, by Alex. Tullock (afterwards Major-General), published by Clowes in 1839, a few deaths from *cynanche tonsillaris* and *cynanche trachealis* are noted as having occurred in 1830-7 among dragoons, foot guards and depôts; but no special remarks on these diseases are given, and there is no word about *cynanche maligna*. Tullock records that among the soldiers stationed in the Ionian Islands in the twenty years, 1817-36, there were 577 admissions and eight deaths from the two diseases (*cynanche tonsillaris* and *trachealis*) in an average strength of 3,514. In Malta, during the same period, there were 579 admissions and three deaths from these ailments in a strength of 2,041.

That diphtheria was occasionally met with among the troops early in the nineteenth century is, however, evident from the number of specimens of membranous croup, &c., in the Army Medical Museum, and from the entries in the Museum catalogues. Thus, in the catalogue of 1833—No. 22, larynx, exhibiting the adventitious membrane formed in croup. Nos. 18 and 25 are similar. No. 31, larynx and trachea, exhibiting high inflammation of their mucous lining with lymph effused on its surface, said to have been secondary to measles. Nos. 33 and 35, ditto after small-pox. No. 35 from Portsmouth. No. 37, "larynx exhibiting destruction of part of lining membrane and deposition of coagulable lymph—Malta—taken from an infant who died of the effects of the disease." In the 1845 catalogue are further entries of the same kind. Some of the specimens are still to be seen; Nos. 400, 401 and 402 of the 1892 catalogue being examples of membranous croup.

The French troops seem to have carried the disease with them to Russia (during the Crimean War), where they suffered heavily, though the English troops had little or none of it. The English official medical report of the war does not mention the disease, but a pathological specimen (No. 403), consisting of a British soldier's larynx and trachea covered with false membrane, is noted in the Netley Museum catalogue as having been received from Scutari. The fact of the specimen being sent suggests that it was rare. Among the French soldiers the disease in the form of wound diphtheria would appear to have caused great mortality; thus Sir Thomas Longmore in "Gunshot Injuries," on the authority of the French Surgeon, Delpech, describes "three forms of hospital gangrene, viz., the ulcerative, the pulpous and the gangrenous; the two latter the graver forms of the disease. . . ." He writes: "It

is chiefly in the pulpy form of hospital gangrene that the false membranes are produced which have originated the name of 'wound-diphtherite,' for the disease. The granulations of the surface of the wound in this variety first became dull and turgid in appearance, and are then covered by a layer of white or ash-coloured exudation with dark points, which quickly increases in thickness and consistence.

. . . This false coating is strongly adherent to the granulations beneath; it can be peeled off them like an elastic false membrane, though with difficulty, and not without giving rise to oozing of blood from their surface. When this coating has acquired a certain thickness it softens down, becomes putrid, and emits a horrible foetid odour. If this can be removed, a fresh layer of false membrane may be formed beneath, to go through a similar transformation." From the description there can be little doubt that the word "diphtherite" might well have been used in its modern significance in the description of this hospital gangrene. Sir Wm. Aitken, in the "Report on the Pathology of the Army in the East," published by Eyre and Spottiswoode in 1856, describes the pulpy fungating gangrene (which I take to have been diphtheria) in the French hospitals at the Crimea and Constantinople, but says it did not occur in the English hospitals. He does not otherwise mention diphtheria or throat disorders, and he remarks that catarrh and respiratory diseases were remarkably rare during the campaign, considering the amount of exposure undergone. The English had neither wound-diphtheria nor throat-diphtheria—the French had both.

During the time when our country was overrun with diphtheria in 1858-9, &c., the army does not appear—judging from the Army Medical Reports—to have suffered much from the disease. This remarkable freedom during the height of the epidemic prevalence must have been very striking and satisfactory, one would think, yet no comment on the fact is made in the reports; and in Dr. Balfour's summary for the fifty years or so preceding the issue of the first Army Medical Report in 1859, diphtheria is not even mentioned. In 1860, there were returned in the United Kingdom only two admissions and one death among the troops for this disease. A general increase of sore throat and influenza is noted (these diseases being grouped together), especially at Woolwich, Chatham, Walmer, Fermoy and Stirling, but the second disease of the group seems to have caused most of the increase. In the preceding year there were twelve admissions, but no deaths from diphtheria. During the same two years we find :—

1859	.. ..	117 admissions, 8 deaths from scarlatina.
1860	.. ..	103 admissions, 4 deaths from scarlatina.

This gives a death-rate of 111 per million in 1859, the strength for the United Kingdom for that year being 71,715. The rate is rather high for adults; thus, in the decennium 1861-70, the civil death-rate for males from this disease was, at ages 20 to 25, 80 per million; 25 to 35, 47 per million; and 35 to 45, 23 per million; while for the period 1881-90, these rates had come down to 23, 16 and 10 per million respectively. Diphtheria and scarlet fever were confused one with the other up to the time of the recrudescence of the former disease, and this fact may account for the small rates given in the Army Medical Department Reports for diphtheria. A study of the Army Medical Reports up to 1894 might, indeed, lead to the supposition that diphtheria has all along had a very slight incidence on military communities throughout all portions of the British Empire, and in the opinion, probably, of the greater number of the Officers of the Army Medical Service, the disease had in fact such slight incidence, the cases in the 1895 Reports notwithstanding.

The So-called Aldershot Epidemic of 1895.—The 1895 Reports would perhaps have been equally free from the word “diphtheria” if the system of bacteriological diagnosis had not been brought into use. Under this system swabs from sore throats were sent by post to Netley for examination. The result of the system was that 412 cases were returned among the men at Aldershot. *Only one of this large number died.* A sensation was caused by the supposed increased prevalence. The camp was thought to be undergoing a great epidemic. I remember being advised not to go to Aldershot owing to the unhealthiness of it. It is obvious from the wording of the official A.M.D. reports that but for bacteriological diagnosis, many of the cases would not have been styled diphtheria. At the same time the amount of throat sickness varies from year to year no doubt, and 1895 was apparently a bad year; but only in this sense was the disease epidemic. The Medical Officer, however, finding that mild throats, to which he had been during all his service accustomed to apply the terms sore throat or tonsillitis, were now perforce styled diphtheria, was sometimes sceptical as to the value of bacteriological methods, and talked about the pseudo-bacillus; he also pointed to the fact that the cases generally get well without special treatment. To show how general was this opinion as to the non-existence of diphtheria among soldiers, I may mention that during a lengthy experience of military hospitals, both great and

small, at home and abroad, I had never once, up to 1895 inclusive, seen a case diagnosed diphtheria in an army hospital. Yet many young surgeons, fresh from the study of medical treatises, must have noticed the correspondence of numbers of the throat cases in our hospitals with the description of benignant diphtheria given by Trousseau and others. Morel Mackenzie, in 1879, aptly says: "In mild or catarrhal diphtheria, the symptoms are often so slight that the practitioner hesitates to attribute them to a disease, the very name of which is heard with consternation." These words would represent also the Service attitude in the matter, and added to the fact that (1) diphtheria has very slight mortality among able-bodied men of the soldiering age, and that (2) the surgeon was not, until 1895, able to fortify his opinion by bacteriological evidence, sufficiently explain why the military surgeon grew almost to forget that such a disease as diphtheria was still to be met with among adult men. In Parke's "Hygiene" diphtheria receives scant mention among diseases of soldiers, and if further proof be wanted that this disease has been regarded as of little importance in the army, it may be noted that in the Report for 1896, and many preceding years, the statistical department of the Medical Division of the War Office has not shown diphtheria as a separate disease, but has included it among "other diseases" in Sub-group 1 of Group A of General Diseases, whereas such a rare sickness as yellow fever is accorded a separate heading. This has been altered, probably owing to the increased numbers in 1895; diphtheria now has a line to itself in the returns.

The omission of diphtheria from the returns makes it difficult to estimate the extent of prevalence of the disease in the army prior to 1897; but an endeavour will be made to show, by aid of information gleaned from remarks by the Principal Medical Officers in the "Abstracts" of sickness of troops in their districts, and by my own recollected experience, that diphtheria has long been prevalent to a considerable extent in the Service, and has for some years, in all probability, contributed largely to the total inefficiency of the troops in the United Kingdom; and has, moreover, caused a death roll equal to that among people of the same age in civil life. Furthermore, it will be shown that among the wives and children of the non-commissioned officers and men, the death-rate has been very high, and that taking men, women and children together, the rate, in spite of the preponderance of the men in point of numbers, has exceeded that of many large English manufacturing towns. Most of the very few cases returned among the soldiers themselves in

pre-bacteriological times, have been so returned in all likelihood, because death and *post-mortem* examination, or perhaps paralysis, revealed the nature of the case.

Army Diphtheria in 1860.—In the Army Medical Report for 1860—United Kingdom—we find for men alone:—

				Admissions.	Deaths.
Diphtheria	..	..	..	2	1
Tonsillitis	..	..	..	3,282	3
Laryngitis	..	..	..	34	1
Scarlet Fever..	..	..	..	103	4

and this report will serve for a type of all the earlier reports. It would of course be out of the question to rely upon tables of case mortality from such small numbers, nevertheless, it may be noted, as to some slight extent confirming the impression that only the severest and most typical cases have been diagnosed diphtheria, that the percentage mortality of these few cases is very much higher than it ought to be at the soldiering age. The mortality at these ages is comparatively low among civilians, thus among 1,190 cases aged between 20 and 40 admitted into the Metropolitan Asylums Board Hospitals from 1888 to 1894, the percentage mortality was 4·87. Lennox Brown gives a mortality of 4 per cent. in cases over 15.

In London in 1895, among 476 cases notified as occurring in males between the ages 20 and 45, the mortality was only 3·2 per cent., and among 238 men aged 25 to 35, it was only 1·7 per cent. In 404 cases between 20 and 35, the rate was 2·2 per cent., and in 300 between 25 and 45 it was 3·3 per cent. (Antitoxin was in use during this year, 1895.)

In 1893 and 1894 the case mortality among those aged between 25 and 35, noted in London, was 2·8 and 2·4 per cent. for the two years respectively. For ages 20 and under 25, during the same two years, the rates were 3·2 and 4·5.

It may be assumed that these cases among adult wage-earning men were not very mild, or they would not have been notified.

Standard Army Case Mortality.—It would appear, then, assuming the military age to be 20 to 35, an age which will include the majority of soldiers, that we ought not to expect a case mortality of more than, at the outside, 1 to 2 per cent. in the army, composed as it is of men of selected physique, living under healthy conditions, well looked after by specially trained medical officers, and taken into hospital for any kind of sore throat. Before the effect of the introduction of short service began to be felt the majority of soldiers were between 20 and 40 years of age. In 1874, according to the

"General Annual Return of the British Army," 860 in every thousand were in the 20 to 40 age group; 733 in the 20 to 35 group; 60 per thousand were in the 19 and 20 group, only 16 per thousand were under 18, and 28 per thousand over 40. In 1893, when the short service system was in full operation, 806 per thousand were in the 20 to 40 age group; 784 in the 20 to 35 group; 725 in the 20 to 30 group; 102 in the 19 to 20; 66 in the 18 to 19 group; 18 under 18, and only 8 per thousand were included in the age group 18 to 40. Practically, in the early period mentioned, three-quarters of the men were in the 20 to 35 group; and in the later period, three-quarters were in the 20 to 30 age group.

Standard Army Death-rate for Diphtheria.—In selecting a standard for death-rate, note may be made of Dr. Longstaff's estimate that among males between 20 and 45, the death-rate for the period 1855 to 1880 (twenty-six years) was 23 per million living; for the age 25 to 35, the rate was only 19 per million, and the same for age 35 to 45. For London in 1895 the rate was as follows: 20 per million for ages 20 and 25; 10 per million for ages 25 to 35, and 20 for ages 35 to 45. In view of my remarks above, we may then assume a standard diphtheria death-rate for the British soldier of at most 10 to 15 per million living.

Now with reference to the 1860 Army Medical Report, we have no means of ascertaining the attack-rate among civilians for tonsillitis and laryngitis, but we have the death-rates to guide us. For the twenty-four years ended 1878, these two diseases together gave an annual average of 66 deaths per million living at all ages, a high rate. In 1895 it was 33·8, say 34. The strength of troops in the United Kingdom in 1860 is shown in the Report as 97,703, and there were four deaths from tonsillitis and laryngitis together, which gives us a death-rate of 41 per million; nearly two-thirds that of the average in the twenty years for the civil population, though the latter includes women and children, and the ratio of deaths of children to adults is in the proportion of four to one for these diseases.

In 1894 the deaths in England for male children under 15 numbered 837, and for adults over 15 only 210, which would make our death-rate appear really a very high one; and we may therefore guess that some of the army cases were diphtheria. Say 20 per million of these were diphtheria, then add them to our diphtheria deaths (10 per million) and we get 30 per million, which is much above our standard of 10 to 15, and is above Longstaff's rates and the London rates before-mentioned, for men of similar

ages. Unfortunately, statistics of sickness among women and children do not appear in the earlier army returns, so we have no means of comparing their rates with those of the civil population.

Diphtheria in Later Years.—To come to more recent years, I will begin with 1890, because I myself had experience of sore throats in Aldershot at that time, and I recollect many severe cases in which there were largish white patches on the tonsils, distinct in appearance from the whitish-yellow spots in follicular tonsillitis. I also had occasion to tracheotomise a lad (admitted for sore throat and subsequently returned as œdema of the larynx); he died some six hours afterwards, the tube being quite free from obstruction; while I developed a sore throat with white patches on the tonsils. I saw a similar case which had been tracheotomised by another surgeon for œdema of the larynx, to die apparently of dyspnœa three days later; to the best of my recollection this case had been admitted for bronchitis. At that time sore throat was common and severe among the troops in Aldershot, and in the light of more recently acquired knowledge and experience, I have no doubt that a large number of cases were really diphtheritic.

The Report for 1890, however, shows only one case of diphtheria at Aldershot. There was also one man who died of diphtheria while on furlough, but whether from disease contracted at Aldershot the Report does not say. But there were in the army in the United Kingdom five deaths from laryngitis and œdema glottidis in a strength of 100,120, say 49 per million living, for these two diseases together. Now the number of male civilians at the soldiering age is, say, 3,000,000—as a matter of fact, it is more than this; from the Census Report for 1891, I gather that there were, in that year in England and Wales, 3,366,203 males aged 20 and under 35 (to be on the safe side it is better to understate it), and the number of male deaths from “laryngitis” and “other diseases of the larynx and trachea” (the latter term includes œdema glottidis), in the same age-period averages roughly 25; in 1891 it was 39, in 1894 it was 22, in 1895 it was 15; but to give a margin for error, and to allow for the few soldiers above and below the age-period we are working on, let us say that the average number of civil deaths for these diseases is 30. Dealing thus liberally we get a death-rate of only 10 per million, which is less than one quarter of the military rate for 1890. It may therefore be justifiably assumed that at least half these army deaths were really due to diphtheria. This gives us half of 49 per million—say 24 per million—which is much above our standard of 10 to 15 per million, is equal to Longstaff’s rate, and higher than the 1895 London rates.

The five deaths in the army in 1890 for laryngitis and œdema occurred among 107 cases. This laryngitis mortality of 4·6 seems high; but the case mortality statistics of this affection in adults for comparison are scanty, and I cannot therefore say that this high rate of itself also points definitely to specificness in the laryngitis.

In 1890 there were 7,030 admissions to military hospitals in the United Kingdom for affections of the mouth and throat, and in the Report for the year it is said that the highest ratio of prevalence of these diseases was in Aldershot, the next two, nearly as high, being Woolwich and the Eastern District. A considerable proportion of these cases at other places besides Aldershot were probably diphtheria.

On page 357, for reference, is a table of statistics of diseases of the respiratory system, &c., among military people.

Outside Aldershot, 1895 seems to have been a fatal year, judging by the deaths among the men, there being six deaths in a strength of 83,711, which gives a death-rate of seventy-two per million. These six deaths occurred among thirty-three cases, whereas the London case mortality for the same year among males between 20 and 35 was only 2·2 per cent. Here, again, we are obliged to draw the conclusion that only the severest cases appear in the army returns, the remainder being shown under other disease headings. In confirmation of this suspicion it may be noted that Fermoy¹ the same year shows five deaths in eighteen cases among soldiers—a case mortality of 27 per cent., which is very high indeed for adult males.

Diphtheria among Women and Children of the Army.—A better idea of the comparative extent of diphtheria prevalence among the military may be obtained by taking into our calculations the wives and families of the non-commissioned officers and men. To take 1894, the year preceding the use of anti-toxin and bacteriological diagnosis. The total strength (see table on page 357) of men, women and children was 131,273, with sixteen deaths from diphtheria and six from croup—making the death-rate for the whole military population of the United Kingdom, excluding officers, 122 per million for diphtheria, and 168 per million for diphtheria and croup together; rates which, in spite of the excess of adult men in the community, exceed the average of the years 1885-94 for both sexes and all ages for, among other places, Nottingham and Hull, with 80 per million each, and Bradford

¹ Fermoy, it will be remembered, had established a reputation in 1860.

SOME STATISTICS OF DISEASE AMONGST SOLDIERS AND THEIR FAMILIES IN THE UNITED KINGDOM.

Year	Strength	Diphtheria		Laryngitis and edema of glottis		Croup		Bronchitis		Affections of mouth and throat (chiefly sore throat, tonsillitis and quinsy)		Remarks
		Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	
Soldiers	1890	100,120	6	107	5	—	—	—	13	7,030	—	1 diphtheria case, Aldershot.
	1891	99,308	2	178	1	—	—	—	10	7,550	1, quinsy	1 diphtheria case, Aldershot.
	1892	100,302	6	178	3	—	—	5,502	9	8,307	—	No detail given.
	1893	100,105	4	—	—	—	—	4,643	9	9,292	—	No detail given.
	1894	99,360	8	111	—	—	—	—	5	6,170	0	2 cases diphtheria, Netley; 3 cases diphtheria, 1 death, Aldershot.
1895	99,795	445	7	145	1	—	—	4,792	14	—	—	412 cases diphtheria, 1 death, Aldershot; 18 cases diphtheria, 5 deaths, Fermoy.
Women	1890	10,591	3	—	—	—	—	—	3	261	0	
	1891	10,229	2	11	—	—	—	647	—	295	—	
	1892	10,216	—	—	—	—	—	—	4	—	—	
	1893	10,379	—	—	—	—	—	—	1	—	0	
	1894	10,761	3	14	—	—	—	491	3	—	—	
1895	11,184	7	—	2	—	—	—	480	—	—	—	
Children *	1890	21,371	16	20	2	22	6	2,974	127	898	2, quinsy	3 diphtheria, 1 death, Aldershot.
	1891	20,727	25	32	1	30	10	3,066	105	897	—	1 diphtheria, 1 death, Aldershot.
	1892	20,392	14	6	3	—	5	2,916	87	—	—	Diphtheria, 3 cases, Aldershot; also 2 laryngismus, Aldershot.
	1893	20,634	20	8	1	—	18	3,129	80	—	—	
	1894	21,152	24	13	3	25	6	3,092	90	1,077	—	5 cases diphtheria, 3 deaths, Aldershot; 5 cases diphtheria, 3 deaths, Netley.
1895	21,607	89	19†	—	—	—	4	—	103	—	—	61 cases diphtheria, 6 deaths, Aldershot.

Where no information is given in the column it is because none is available.

* Children in the army means boys and girls under 14.

† The detail makes the total 20 for children in 1895, but the report in another place gives it as 19. See Table on p. 360.

with 60; and it equals the average annual rate of the whole country (121) and of London (122) for the years 1871-80.

If now we divide the strength and deaths of children by two, to exclude the males, and add to the result the strength and deaths of women, we get:—

$$(21152 \div 2) + 10761 = 21337 \text{ strength.}$$

$$(13 \div 2) + 1 = 7.5 \text{ deaths.}$$

which will represent the strength and deaths of the female population of the army in the United Kingdom with sufficient accuracy for our purpose.

High Mortality among Army Females.—We have thus brought the military population into line with the civil (except that there are no old and no unmarried women), and we find the death-rate per million for army females is 352, a sufficiently striking result indeed, inasmuch as this rate exceeds the female-rate (187) for the whole country for the years 1855-60, during which the great epidemic prevailed, and also that for 1860-70, which was 191, and is more than double that for 1871-80, which was 125. It exceeds also the average for these twenty-six years, 1855 to 1880, which was only 168. Furthermore, it is in excess of the civil female death-rate for any year since 1880, not excepting the fatal year 1893, when the rate was 312. It is also far above the average general diphtheria death-rate for London to 1890 inclusive. It is higher than the rate for the thirty-three great towns (London included) for 1885-94, and equals it for 1895. It is likewise more than the rate for the sixty-seven large towns for the few years in which collective returns for these towns had been published at the time we are dealing with.

The children who died in home stations other than Aldershot in 1895 numbered thirteen, which was equal to the total of the previous year. Estimated in the same way as for 1894 we get—strength of females 21,988, deaths 9.5, which gives us a rate of 432 per million, in contrast to the thirty-three large towns (including London) with a death-rate of 350 (in round numbers), and only 100 per million behind the high general diphtheria death-rate for London for the same year.

Evidently diphtheria is very prevalent among the wives and families of soldiers.

Diphtheria in our Foreign Stations.—Outside the United Kingdom diphtheria appears from the reports to be very uncommon. In 1901, for instance, there were four admissions (one each Gibraltar and Malta, two India) among the men.

The incidence among children for the same year is set forth in the table below:—

DIPHTHERIA AT FOREIGN STATIONS—CHILDREN ONLY—1901.

Station	Strength of children	Admissions	Deaths	Remarks
Gibraltar	594	5	—	
Malta	813	5	1	
Canada	230	—	—	14 admissions for diseases of throat and mouth.
Bermuda	153	—	—	4 ditto.
Barbados	108	—	—	
Jamaica	89	—	—	5 sore throat.
West Africa	30	—	—	(Negroes).
Mauritius	76	—	—	
Ceylon	127	—	—	
China*	105	—	—	
Straits Settlements ..	56	—	—	
India	5,069	—	—	Admissions for laryngitis 6, croup 4.
Egypt and Cyprus ..	298	3	1	
South Africa and St. Helena	No return.	In 1898 strength 717,		no diphtheria. One death laryngitis.

* Hong Kong formerly showed no diphtheria among civilians, but the death-rate from quinsy was significant. In 1886, out of 5,100 deaths in a population of 180,000, no less than 523 were styled "quinsy."

Fatality among Army Children.—Among children there was in Aldershot in 1890 one death among three cases, and in 1891 there was a single case which died, while in the same period the croup deaths among army children in the United Kingdom practically equalled the diphtheria deaths, whereas in England generally the diphtheria deaths among children were twice as numerous as those for croup. In 1894-5 there were only twice as many diphtheria deaths as there were croup deaths among the army children, while in the whole country there were four times as many. Thus in 1894, diphtheria 8,330, croup 1,740; and in 1895, diphtheria 7,540, croup 1647, for children under 15. In London, 1894-5, the deaths of children from diphtheria were some seventeen times as many as those from croup.

The proportion of deaths to cases among army children may best be set forth in a six years' table (see next page).

The case mortality tells its own tale, in spite of the smallness of the numbers—the most striking thing in this table is the number of instances in which there is one case one death. In 1895, in Aldershot, where bacteriological diagnosis was freely resorted to, there were sixty-one cases with six deaths, giving a case mortality

360 *Prevalence of Diphtheria in the British Army*

of 9·9 per cent., the remaining twenty-eight cases for the United Kingdom (in stations still relying chiefly on clinical diagnosis), with fourteen deaths, giving a case mortality of 50 per cent., the latter rate being similar to the total diphtheria case mortality of army children in 1894, which was 54 per cent. In London during the same year (1895), there were notified 8,923 cases in civil children under 15, and of these 2,288 died, giving a case mortality of 26 per cent.—just half that of the army children (exclusive of the Aldershot cases.)

DIPHTHERIA CASES AND DEATHS FOR SIX YEARS, 1890-5, ARMY CHILDREN ONLY.

Places	1890*		1891		1892†		1893		1894		1895‡		Totals§		Remarks
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	
Aldershot	3	1	1	1	3	2	5	3	61	6	73	2	<p>° The Report for 1890 shows only 16 cases in the total, but 17 in the detail. † The Report for 1892 shows no detail of the 6 deaths. ‡ In 1895 there is a discrepancy between the total (19) and the detail (20) in the Report. § In the column for total deaths the detail is not given, in the A.M.D. Reports, for each station. The detail therefore does not equal the total. || Shrewsbury, Shoburnyness, Galway, and Newbridge.</p>
Woolwich .. ..	..	..	..	..	2	2	3	0	4	2	6	4	15	2
Netley .. ..	..	..	..	..	..	..	..	..	5	3	2	0	7	3
Chatham	5	1	..	..	..	..	..	..	1	0	..	..	6	1
Thames District ..	..	..	1	1	4	2	..	..	..	..	..	..	5	2
Devonport	1	1	..	..	..	..	1	0	2	0	..	..	4	1
Dublin District ..	..	..	1	1	..	..	..	..	..	..	..	..	1	1
Gosport	1	1	..	..	..	..	..	1	1	..	..	..	2	2
London and Home District ..	..	..	3	0	..	..	2	1	1	1	..	..	6	2
Portsmouth and Southern District ..	1	1	1	0	..	..	..	..	..	..	..	..	2	1
Cork District .. ..	..	..	3	3	..	..	..	..	..	..	..	..	3	3
Southampton	1	1	..	..	..	..	..	..	..	..	..	..	1	1
Eastern District ..	..	..	5	2	..	..	..	..	..	..	..	..	5	2
Londonderry	1	1	..	..	..	..	..	1	1	..	..	..	2	2
Leith, Edinburgh and Scottish District ..	1	0	10	2	2	2	..	..	..	..	..	..	13	2
Harwich	1	0	..	..	..	..	..	..	..	..	..	..	1	0
Taunton	1	0	..	..	..	..	1	0	1	0	..	..	3	0
Portland	1	0	..	..	..	..	..	..	..	..	..	..	1	0
Hamilton .. ..	..	..	..	..	..	..	..	2	2	2	1	4	3	3
Guildford .. ..	..	..	..	..	..	..	4	1	1	0	..	..	5	1
Fermoy .. ..	..	..	..	..	..	..	..	..	..	5	1	5	1	1
Jersey .. ..	..	..	..	..	..	3	3	..	3	2	6	5	6	5
Curragh .. ..	..	..	..	..	..	..	..	..	..	2	1	2	1	1
Buttevant .. ..	..	..	..	..	..	..	..	..	2	1	2	1	2	1
Chester .. ..	..	..	..	..	..	..	..	..	1	1	1	1	1	1
Worcester .. ..	..	..	..	..	..	..	..	..	..	1	1	1	1	1
Colchester .. ..	..	..	..	..	..	..	..	..	1	1	1	1	1	1
Maidstone .. ..	..	..	..	..	..	..	..	..	1	1	1	1	1	1
Shorncliffe .. ..	..	..	..	..	..	4	3	..	..	..	..	4	3	3
Queenstown .. ..	..	..	..	..	..	1	0	..	..	..	..	1	0	0
Other Stations ||	..	..	..	..	3	2	1	0	..	2	0	6	2	2
Totals	17*	7	25	10	14	6†	20	8	24	13	89	20‡	189	64§	

It will be seen that in the table I have shown some places by stations and others under their district headings; this is because the reports do not always indicate the actual stations in which the cases occur.

The inference to be drawn from these contrasts is that the apparent high mortality among army children was really due to *unrecognised mild cases of diphtheria* being shown under some other headings, such as croup, tonsillitis or sore throat, laryngitis, and even bronchitis, &c. Diphtheria cases have been found under these names.

Foci of Diphtheria in Camps and Garrisons.—Another point which is prominently brought out in the foregoing table is that diphtheria was present in nearly all our camps and garrisons. That soldiers suffered a great deal from sore throat is, therefore, not to be wondered at. It would seem, indeed, that some of the military garrisons and camps have been endemic haunts of diphtheria, more notably Aldershot. If the military population of Aldershot Camp had been composed of people of various ages and both sexes in the same proportion as in civil life, it would, at the same death-rate which has been worked out above, have occupied a very unenviable position indeed as regards diphtheria prevalence.

Whatever was the cause of the sudden increase in the number of diphtheria cases shown as such in army returns for Aldershot camps in 1895, a marvellous improvement has since taken place. The decrease began in 1896 among the men, there being 177 cases and no deaths during that year; but there were 51 cases with 6 deaths among the children. In 1897 there were 22 cases among the men, but there was an increase to 96 among the children. In 1898, cases: men 6, women 1, children 33, with 7 deaths. Most of these occurred in the latter half of the year. From the middle of February to the end of June there had been no cases, and the disease was, therefore, thought to have been reintroduced from the town, where an epidemic prevailed, and ultimately became the subject of a Local Government Board enquiry. In 1899, men 5 cases, women 4, children 81, with 20 deaths (of these children 18 cases with 4 deaths occurred among people living out of barracks, that is to say, among the civil population of the town and presumably mixing with camp children in the army schools). In 1900, men 5 cases, children 3; these last numbers, as the Principal Medical Officer remarks, "form a great contrast to the state of things in former years." The favourable state continues, the admissions for children during the years 1901-2-3 being 10, 12 and 8, with 3, 3 and 1 deaths respectively.¹

This course of events seems to fit in with the views put forward,

¹ 1903 is the last available report.

and may be looked upon as a triumph for bacteriological diagnosis. It might be expected that the improvement would begin among the men. In the meantime, in consequence of the sensation caused by the publication of the returns concerning the men, increased attention would be paid to the children's throats, with the immediate result of an increase in the number recognised and reported for 1897. Then all was over. The disease brought in again late in 1898 was confined to the children and was soon wiped out, with the happy result mentioned by the Principal Medical Officer in 1900, and still maintained.

The history of diphtheria in Aldershot Camp is instructive alike to civil and military. It shows, moreover, what excellent preventive means we possess if only we can get them carried out. There seems to have been nothing in the camp itself likely to conduce to prevalence of diphtheria—rather the other way, in fact. There are no poor and no slums, and the place is well sanitated.

That, in a general way, *camps are healthier than towns*, is shown by the death-rates for camps (including Aldershot, Colchester, Shorncliffe and Curragh) being lower than that of towns during the period dealt with; thus, according to Army Medical Department Reports, the general death-rate per 1,000 living in camps and towns for the six years 1890-95, for men only, was:—

				Camps.		Garrison Towns.	
1890	..	..	..	4·71	..	..	5·67
1891	..	..	..	4·23	..	..	5·26
1892	..	..	..	3·27	..	..	4·25
1893	..	..	..	3·92	..	..	5·36
1894	..	..	..	2·36	..	..	3·99
1895	..	..	..	3·31	..	..	4·77

Aldershot was not an unhealthy station. In 1890, of the sixteen military districts, *Aldershot with 4·45 had the lowest death-rate*, except the Thames and three Irish districts, per 1,000 living. In 1894, too, with 2·41, Aldershot was healthiest except four—Curragh, North-Western, Thames and Channel Islands districts only being healthier. In 1895 the camp was not so fortunate; it was, however, only eighth in order of unhealthiness, in spite of the diphtheria.

Milk was excluded by the local authorities as the cause of the so-called Aldershot epidemic of 1895; the Lincoln Regiment even went to the extent of trying the effect of using condensed milk only, but without benefit.

Soldiers' Married Quarters.—The married soldier lives with his wife and children in one small room about 14 feet square, which

serves for eating, sleeping, and living room; his quarters, indeed, in the older barracks, are inferior to model artisan's dwellings; and this crowding together cannot be, to say the least of it, conducive to freedom from diphtheria. If the man has more than two children, or, on the score of decency, if his children are over five years of age, he may get two rooms (see latest King's Regulations, 1904).¹ Considering that the wife is usually engaged in washing the underclothing and handkerchiefs of the single men, and that half the work connected therewith is done in the family room or rooms, it is probable that the disease is occasionally carried from the barrack rooms to the quarters (and *vice-versâ*). All the same, it is certain that the civilian poor are much more insanitarly situated than are soldiers, and we must look elsewhere for the cause of army diphtheria.

Military Customs aiding Diffusion of Diphtheria.—There are military customs which would aid in the spread of diphtheria, when once the disease has been started in a regiment, in addition to the risks engendered by living and sleeping in large numbers in common rooms. Thus, it is the habit of the soldier to spend his evenings in the canteen, where the men are packed like sardines, and the atmosphere is overpowering, especially in the older canteens, from about 7 p.m. in the winter. It is as bad as if he went to a crowded theatre every night.

It is the habit of soldiers to drink beer in common out of a metal measure. The measure is of tinned-iron or pewter, and the former is particularly hard to clean at the brim, hot water being rarely employed. The vessel is passed round among a number of men who form a drinking party. In this way a tin measure may be used by a dozen or more men in one night, without intermediate cleansing. Add to this that the soldier is apt, when he feels ill, to resort to beer in the attempt to "shake off" the sickness, or to procure temporary alleviation, until he can "go sick" the next morning, and we have an excellent means of disseminating diphtheria through a regiment.²

The plates and the tea basins in the barrack room are also a likely means of conveying infection. Dish-cloths are scarce and not

¹ Endeavours are now (1906) being made to arrange that only married couples without children should be restricted to one room quarters; families with children are to get two rooms.

² This custom is now being changed—glasses are being used by order—not, however, with the idea of diminishing infectious disorders, but to decrease the amount of tippling.

too clean; sometimes there are none, and the men use their face towels to dry their crockery. A man does not always use the same plate or basin, and these articles are scarcely ever put into really hot water.

Given an infected man in a barrack room it may be taken in a general way that the rest of the men handle the same furniture, utensils, door-latch and panels as he does.

Then, too, while standing in the ranks the soldier who coughs must do so without regard to the proximity of the faces of his comrades.

Chronic Diphtheria without Symptoms.—In this connection mention may be made of chronic diphtheria as exemplified in a case of my own. Private —, M.S.C., stated that he had been subject, off and on, to sore throat since he had a bad attack four years before. In June he had an acute attack of diphtheria, and bacilli were found. After recovery the tonsils were enlarged and were therefore guillotined. In August, when he had been some time out of hospital, I cultivated diphtheria bacilli of medium virulence from his throat; he then showed nothing but enlarged tonsils. On November 12th I again examined the man; he was not very strong looking, but was at his duty; both tonsils were enlarged. There was a pocket (result of a former abscess) in one tonsil, into which I passed a glass rod for half an inch. Cultivation from the rod after it had been passed down the hole in the tonsil, gave a plentiful growth of streptococci, many staphylococci, and a good number of long diphtheria bacilli. In appearance the tonsils did not differ from ordinary enlarged tonsils.

Five weeks later this man was again examined. The tonsils were still enlarged, but less so than on the previous examination. He had had no fresh attack and felt quite well. Cultivation from the throat showed plenty of diphtheria bacilli.

One cc. of his blood was mixed with one minimal lethal dose of toxin and injected into a guinea-pig by way of testing the man's immunity. Twenty-four hours later the guinea-pig had a soft local swelling of moderate extent. The following morning it was found dead in its cage.

Unfortunately this experiment is unreliable owing to disease among the guinea-pigs—a control guinea-pig kept in a cage alongside the experimental one died the same night. *Post-mortem* examination of the experimental animal seemed to show, however, that it had not died of the toxin. There was some local extravasation of blood, but very little, if any, œdema. There was no pleural effusion and very doubtful inflammation of suprarenal capsules.

There were no more guinea-pigs at my disposal at the time.

Another case, Private D., Dorset Regiment, was probably of similar character, but the man passed out of my reach. The patient was invalided from abroad for syphilis. He had suppurating glands beneath the angle of the jaw and he had chronically enlarged tonsils. He was anxious to have the tonsils removed, but I decided to remove the suppurating glands first. This was done. Fifty-six hours later the man had sore throat, pain in the neck and temperature 100°. My first thought was of sepsis; examination of the operation wound showed that all was right there, but on inspection of the throat, a membranous-looking patch was seen on the tonsil of the side operated on. At night temperature was 104°. Cultivations were made from the throat and *B. diphtheriæ* found. The coincidence of operation and development of diphtheria in the enlarged tonsil of the same side suggested that the disturbance had in some way re-lit an old disorder.

Obviously a soldier like Private —, M.S.C., would keep a regiment going for years with diphtheria. It is hard to know what to do with such a man. He cannot be kept in hospital for ever against his wish, but I think he ought to be kept in until he is apparently free from bacilli, and if, after the lapse of a few weeks or months, they are again found, he should be invalided.

Army Schools—Mild Diphtheria Cases among the Children.—I am unable to give much information as to any possible influence of army schools on diphtheria prevalence. The iron drinking cup chained to the wall near the water-tap, and in common use among a crowd of children, has not entirely disappeared from army schools. The men in many stations use the same school as the children, though at different hours. The Principal Medical Officer, Aldershot, in the 1898 Report—issued in 1900—remarks that the afflicted children were mostly of school age. The general infant mortality in the camp is lower than the average among the civil population. In 1901 it was only 86.

By the courtesy of Dr. A. E. Wright I have been enabled to work up the results of the bacteriological examination of cases in 1895. Some 47 per cent. gave negative results among the men, but curiously enough only 21 per cent. of children were negative. This difference is probably not because they suffer less from sore throat, or because the diagnosis is easier in their case. It may be interpreted to mean that the children with mild sore throats were not brought to the doctor, or that specimens from the throats of slight cases were not submitted for examination, that, in fact, unrecog-

nised subjects of diphtheria were mixing with the other children, and thus keeping up the prevalence of the disease—a state of affairs which would have been remedied by the adoption of measures similar to those of the Board of Health of Massachusetts, where the throats of all the school children are regularly examined.

Summary of Conclusions as to Army Diphtheria.

(1) Diphtheria has for many years prevailed among soldiers at home to as great an extent as, or to a greater extent than, among men of the same age in civil life—a good deal of diphtheria being returned under milder names—and the total resultant military inefficiency has been large.

(2) Diphtheria among soldiers is mostly a mild disorder with low case mortality.

(3) Diphtheria among the families of soldiers is *at least* as frequent and fatal as among civilian families.

(4) The disease is not the result of bad general sanitation.

(5) The disease is possibly favoured in its spread by the mode of life of the soldier in barracks—mostly in matters beyond his own control, consequent on living in common rooms, being close together in the ranks, &c.

The explanation of the absence of diphtheria from army returns in ante-bacteriological days, is borne out also by the later reports. From the last three published annuals I extract the following :—

DIPHTHERIA (UNITED KINGDOM).

OFFICERS				MEN			WOMEN			CHILDREN		
Year	Strength	Cases	Deaths	Strength	Cases	Deaths	Strength	Cases	Deaths	Strength	Cases	Deaths
1901	3,533	3	0	100,811	72	2	10,008	10	..	18,768	137	21
1902	3,581	1	0	93,665	76	3	10,559	6	..	19,539	96	22 ²
1903	4,545	1	0	110,565	32 ¹	2	12,433	8	..	23,277	77	7

¹ Also 166 admissions for laryngitis, and 5,890 for mouth and throat affections. One man's death is registered as laryngitis and one œdema of larynx.

² Also 6 deaths from laryngitis and laryngismus stridulus.

The distribution for 1901 is as follows as far as can be gathered from the returns :—

Officers : 1 each Aldershot, Dundalk and Kilkenny.

Men : 23 Woolwich District, 12 Southern, 7 Aldershot, 7 South Eastern, 5 Home, 5 Cork, 4 North Western, 3 Eastern, 2 North Eastern, 2 Western, 1 Scottish and 1 Dublin.

Women : 3 Portsmouth, 2 Shorncliffe, 2 Dublin, 1 each Colchester, Fort George and Holywood.

Children : 46 Portsmouth, 13 Dublin, 10 Aldershot, 9 Chatham, 8 Colchester, 7 Lichfield. The remainder of the children are not given in detail. The only deaths detailed are 3 each Portsmouth, Aldershot and Lichfield ; 1 each Chatham and Colchester.

It is seen that there is a nominal increase all round since bacteriological methods have been more generally used.

The apparent increase will be still greater, no doubt, when all throat cases are examined by microscopic means.

Local Government Board Enquiry.—Some time after my account of the Aldershot outbreak had left my hands, the result of the Local Government Board enquiry by Dr. R. J. Reece was published ; it is dated August 31st, 1899.

The enquirer is at some loss to explain the "remarkable outbreak in the camp in 1895." He mentions the opening of a laboratory for diagnostic work in 1898. I infer that he is not aware that bacteriological diagnosis was in vogue for Aldershot for a few years before that date. A careful study of his report serves to confirm in my mind the opinions already expressed as to the 1895 epidemic. The population of the camp and town are much alike in point of numbers, viz., 1891 census, town 12,641, camp 16,969. Estimated for town in 1898, 16,500, camp 19,455.

Reece shows the attack-rates per 1,000 for eight years as below :—

ATTACKS PER 1,000.							
TOWN				CAMP			
		Up to 15	Over 15			Up to 15	Over 15
1891	..	1·65	.. 13	..	2·74	..	·07
1892	..	2·38	.. 61	..	6·17	..	·13
1893	..	2·24	.. 60	..	7·92	..	·06
1894	..	4·39	.. 57	..	4·93	..	·25
1895	..	4·75	.. 98	..	25·49	..	23·67
1896	..	6·11	.. 105	..	28·47	..	10·63
1897	..	19·00	.. 102	..	23·65	..	·95
1898	..	22·64	.. 118	..	16·51	..	·23

It must be borne in mind that the town only exists for the camp, and that intercommunication is free.

It will be seen that the camp took the lead in child diphtheria up to 1894. The adult rate was higher in the town than in the camp. Then comes the camp rise of 1895, which I have explained. Then the camp adult rate falls, and Dr. Reece suggests that this may have been due to preventive measures being better in the camp, and to the removal of troops to manœuvres in 1896. The town rates had now gone up. After the camp experience the town had been obliged, in defence of its existence as a military resort, to take to bacteriological diagnosis.

Dr. Reece gives some death-rates which bear me out better than the incidence-rates. He first tells us that in the years 1882-6 there was a special prevalence of diphtheria in the town, and that the town has generally been worse off than the camp, since 1876, in the matter of diphtheria. He then groups diphtheria and allied throat sickness as follows :—

		TOWN			CAMP		
		Cases		Deaths	Cases		Deaths
1894	..	29	..	13	13	..	5
1895	..	36	..	10	454	..	11
1896	..	46	..	9	249	..	11

In 1894-5, the camp death-rate was less in proportion to population than was that of the town, in spite of the enormous increase of cases in camp. The marvellously reduced case mortality of 1895 in the camp cannot have been entirely due to the use of serum. The only explanation, in my opinion, is that already given, that these cases in the pre-bacteriological years would have been returned under a less terror-inspiring nomenclature than that of diphtheria.

The town death-rate has continued, up to the latest date for which reports are available, to be higher than that of the camp.

THE CAUSATION AND PREVENTION OF THE SPREAD OF YELLOW FEVER.

BY MAJOR F. M. MANGIN.
Royal Army Medical Corps.

It is now satisfactorily proved that yellow fever can only be transmitted by the bites of previously infected mosquitoes of the species *Stegomyia fasciata*, and that the disease can only be transmitted by one of these insects feeding upon another human subject, after a lapse of at least twelve days from the time of biting a yellow fever case. The prevention of the spread of the disease, therefore, obviously resolves itself into two modes of action: (1) The destruction of infected insects; (2) the protection of the yellow fever case from the bites of the specific mosquito.

(1) The destruction of the mosquito is beset with so many difficulties that, from a practical point of view, especially in epidemic times, it can be looked upon as a matter of secondary importance.

(2) The second alternative that therefore remains is to protect the yellow fever patient, especially the earlier cases, from the assaults of the *S. fasciata*.

The history of the incidence of yellow fever in Havana, as summarised by Major W. C. Gorgas, Surgeon, United States Army, Chief Sanitary Officer of Cuba, in his official Report to the Adjutant-General, United States Army, dated February 15th, 1902, proves conclusively what can be done by the early segregation of suspicious yellow fever cases. As he states in his Report: "The only infected material from the towns looked after was the sick man, who was carefully sought out and screened from mosquitoes. These results were obtained apart from other stringent sanitary measures. These reduced the death-rate from other diseases to the normal limits obtaining in healthy cities of civilised countries, but had little or no effect upon the yellow fever rate." General disinfection, as carried out for other infectious and contagious diseases, had been most extensively and faithfully tried, but yellow fever only disappeared when the importance of the mosquito *S. fasciata*, as the carrier of the disease, was fully and practically recognised, and, in addition, dealt with. Suspicious cases of fever were from the first screened, and mosquitoes were, as far as possible, destroyed by fumigation, and their reproduction prevented by the usual methods, *i.e.*, oiling pools of water with kerosene oil, and the prompt removal

of tins and vessels capable of retaining stagnant water, &c. To show the marked reduction of the death-rate from yellow fever, following the adoption of the above methods, I quote the following figures derived from the Official Sanitary Reports of Havana, from the year 1900 to 1904. The methods referred to were put in force in the year 1901 :—

1900	..	..	Deaths	310	1903	..	..	Deaths	0
1901	..	..	"	18	1904	..	..	"	0
1902	..	..	"	0					

These results, I think, speak for themselves. It is perhaps unnecessary to add that in the light of modern scientific knowledge, the possibility of yellow fever arising from, or being transmitted by, disturbance of the soil, clothing, or even personal contact with the sufferer from the disease, apart from the agency of the *Stegomyia*, can be safely ignored.

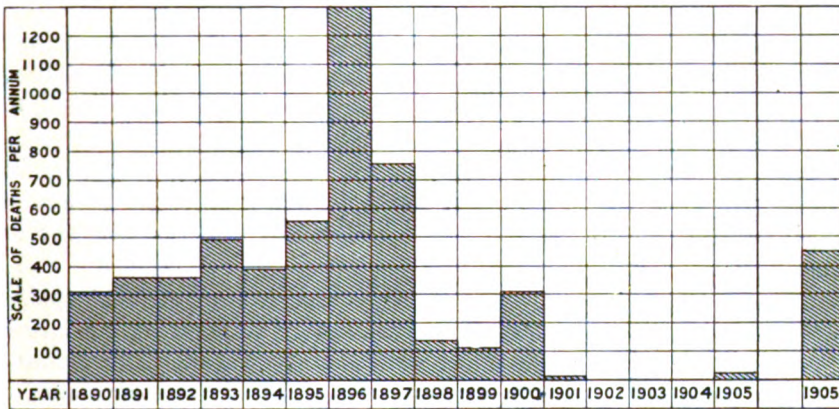
The vital importance of the early recognition and screening of yellow fever cases is fully borne out by the object-lesson afforded by the epidemic at New Orleans in 1905, during the months July to November, which cost the community 420 lives. It is obvious, from a perusal of the Health Reports furnished, that although in July cases presenting symptoms of yellow fever occurred, and were pointed out to the authorities, sufficiently energetic steps were not taken to acknowledge them as such, and so the epidemic was given a starting point. Most thorough means for the extermination of the *Stegomyia* were undertaken, but, as experience showed in Havana, had little effect on the yellow fever rate. The contrast is shown in the management of a small outbreak of the disease in Havana during the months of October to January during the same year, 1905-1906. It must be borne in mind that the population of both Havana and New Orleans are, approximately, the same, *i.e.*, New Orleans in 1905 was 287,000, Havana in 1905 was 275,000, and that the climatic conditions obtaining do not materially differ. The *S. fasciata* abounds in both cities. It is therefore plain that the possibility of the spread of yellow fever in an epidemic form is at least equal in either town, if not greater in the case of Havana, owing to the large number of non-immune immigrants who arrive throughout the year, chiefly from Spain, *e.g.*, in the year 1900, 24,000 immigrants were landed in the latter city.

The measures adopted by Major Gorgas in previous years were put into practice by Dr. Carlos J. Finlay, the present Chief Sanitary Officer of Cuba, with the excellent results briefly alluded to above. The occurrence of anything approaching an epidemic of yellow

fever in this island, entailing, as it would, quarantine for all ships leaving its ports for America and elsewhere, would, in addition to the loss arising from restriction of trade, undoubtedly put an end, at all events for some time, to the present rapidly increasing tourist traffic, which is a source of some considerable profit to Jamaica.

YELLOW FEVER IN HAVANA.
Diagram showing number of deaths per annum, 1890-1905.

NEW
ORLEANS,
1905.



I would therefore emphasise the importance of early segregation of every suspicious case of fever, and the provision of the necessary means (*i.e.*, mosquito screens and netting) for doing so. The destruction of infected insects is also a matter of great importance, but the immediate screening of the patient is more so, bearing in mind the fact that it is for the first five days only that the yellow fever patient can communicate his disease by the medium of the *S. fasciata*.

The above diagram shows the incidence of yellow fever in Havana from the year 1890 to 1905, and the New Orleans epidemic in the latter year. It demonstrates at a glance the value of the measures taken by Major Gorgas in 1901.

ON THE ACTION OF COLD OR LUKEWARM TEA ON
BACILLUS TYPHOSUS.

BY MAJOR J. G. MCNAUGHT.
Royal Army Medical Corps.

WHILE carrying out a series of experiments to determine whether, when milk containing *Micrococcus melitensis* was added to tea, that organism was likely to survive or not, I was led to investigate the action of cold tea upon it. Finding that after a period of contact of five hours or more, *M. melitensis* could not be recovered from cold tea, I proceeded to investigate the action of cold tea on *B. typhosus*. The experiments were carried out as follows :—

Tea was prepared in an ordinary earthenware teapot capable of holding about $1\frac{1}{2}$ litres of fluid. Before proceeding to infuse the tea, the teapot was washed with boiling water. The amount of tea used was three heaped-up teaspoonfuls; the amount of boiling water poured on to the tea in each case was about 1 litre. The tea was allowed to infuse for ten minutes, and filled into sterile test tubes in quantities of 10 cc., then allowed to cool down to room temperature (17° C.). Control tubes containing 10 cc. of peptone-broth were used in each experiment. To each tube was added one loopful of a very dilute emulsion of *B. typhosus*. At varying intervals nutrose-litmus-agar plates were prepared from each tube. The tubes were incubated at 37° C. between the first and subsequent platings. The plates were incubated at the same temperature and examined daily for a period of seven days. The results obtained are shown in the following table.

It will be seen from the table that, after four hours' contact, *B. typhosus* diminished greatly in numbers, and that after twenty hours it could not be recovered from cold tea.

The results obtained are of interest with reference to the question of the use of cold tea as a substitute for water in the men's water-bottles on active service. Even when water is sufficiently sterilised, it is liable to become infected after sterilisation; moreover, water-bottles which have once been filled with infected water are capable of retaining infection for some time. If, how-

ever, tea be carried in the water-bottle, any chance infection with *B. typhosus* would appear to cease to be harmful in the course of a few hours.

ACTION OF COLD OR LUKE-WARM TEA ON *B. TYPHOSUS*.

Test fluid	Quantity of <i>B. typhosus</i> emulsion added	PERIOD OF CONTACT							
		10 minutes		3 hours		4 hours		20 hours	
		Amount plated	Result	Amount plated	Result	Amount plated	Result	Amount plated	Result
Tea I.	One loopful of a dilute emulsion	2 loopfuls	Profuse growth B.T.A.	2 loopfuls	Profuse growth B.T.A.	4 loopfuls	7 colonies B.T.A.	1 cc.	No colonies B.T.A.
Tea II.	One loopful of a dilute emulsion	2 loopfuls	Profuse growth B.T.A.	2 loopfuls	Profuse growth B.T.A.	4 loopfuls	7 colonies B.T.A.	1 cc.	No colonies B.T.A.
Peptone Broth I.	One loopful of a dilute emulsion	2 loopfuls	Profuse growth B.T.A.	2 loopfuls	Profuse growth B.T.A.	4 loopfuls	70 colonies B.T.A.	.005 cc.	Innumerable colonies B.T.A.
Peptone Broth II.	One loopful of a dilute emulsion	2 loopfuls	Profuse growth B.T.A.	2 loopfuls	Profuse growth B.T.A.	4 loopfuls	80 colonies B.T.A.	.005 cc.	Innumerable colonies B.T.A.

THE DISPOSAL OF THE WOUNDED OF MOUNTED TROOPS.

BY LIEUTENANT-COLONEL H. HATHAWAY.
Royal Army Medical Corps.

IN continuation of my article on this subject in the Journal of July, 1905, I ask permission to state that the waggon that was made for me in the Gun Carriage Factory, Fatehgarh, has been in work with a detachment from the Mounted Infantry of the 2nd Battalion Argyll and Sutherland Highlanders, Poona.



FIG. 1.

The original design of the waggon was to carry four recumbent cases, or ten men sitting: it is found that it is quite unnecessary to provide sitting accommodation in an ambulance for mounted troops. The men who do not require lying-down accommodation can, supported by my saddle crutch (described in previous article), ride their own horses, after having received first aid.

Doing away with sitting-up accommodation very materially lessens the weight of the waggon; this is most important, as when empty, touch must be kept with mounted troops proceeding at any pace and over any ground where guns can go. The construction of

the waggon is also made more simple and inexpensive by having no sitting accommodation.

There are many occasions when mounted troops are proceeding light, and must bivouac and keep their wounded with them. I have, therefore, fitted the waggon with detachable canvas curtains, weighing 24 lbs. each, which can be carried on a transport animal, and when required are laced to the waggon on each side and pegged to the ground: protection is provided for fourteen men. The advantages of covering comfortably such a large number of men without carrying a tent are obvious.

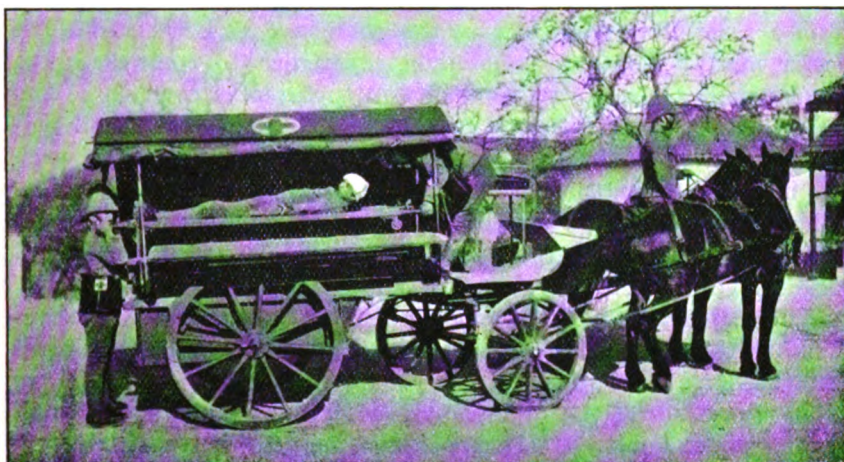


FIG. 2.—A feature of the cart is the facility with which a patient is placed in the upper berth of waggon. The stretcher is pushed along the platform of lower berth, then raised by two men, one standing on platform provided for the purpose at front of waggon, the other standing on ground behind the waggon. When the stretcher is raised sufficiently high the poles are brought forward on to the front cross bar, and the other cross bar behind is hinged up and hooked.

Large canvas bags for carrying pure water are fitted under the driving seat. These bags would be boiled once or twice a week to purify them.

Nothing could be more simple than the construction of the waggon; it is only a platform on good springs and strong wheels; the springs are turned upside down to prevent the nuts dropping out during rough work, the platform projects in front, and the driving seat can be turned aside so as to allow a man to stand on the platform and raise one end of a stretcher when loading upper berths.

DEFECTS OF THE PRESENT SYSTEM OF RESPIRATORY TRAINING FOR THE SOLDIER, WITH HINTS TOWARDS ITS IMPROVEMENT.

BY MAJOR R. F. E. AUSTIN.
Royal Army Medical Corps.

FOR some time past the physical training of the soldier has interested me, and the conclusion that has forced itself on my mind after the examination of a great number of men is that, in spite of his muscles and, in many cases, big chest as well, the so-called "trained soldier" is a "respiratory degenerate." The term "trained soldier" is used advisedly, for, strange as it may appear, from a respiratory point of view the youngster is, I often find, the better man. It is no uncommon experience to come across a recruit with a chest expansion of two to three, or even three and a-half inches, but I have yet to find more than a very small percentage of "trained soldiers" who can show a difference of even two inches between their minimum and maximum chest expansion. (I here allude to honest mobility of the chest, and not to that sham expansion and contraction brought about by the tension and relaxation of muscles covering the thoracic cage.) Now pulmonary suction depends largely, if not wholly, upon the adequate movements of the chest-wall; if this be inefficient air cannot be drawn into the lungs with sufficient force to make it pass fast enough to supply the needs of the organism through the comparatively small openings of the nostrils, so it is not surprising to find that numbers of these men breathe through the mouth more or less continually. It is true that the majority can on occasion use the nose when their attention is specially directed to it; if, however, the mind is taken off the respiratory act, the nasal passages are ignored more often than not, and this is all the more noticeable during some slight extra exertion, such as walking upstairs, &c. It is not necessary, nowadays, to dilate upon the importance of nasal respiration on all and every occasion, for it is well-known that more or less persistent oral breathing leads sooner or later to varying degrees of nasal, aural, pharyngeal or laryngeal trouble. To satisfy myself that there was no nasal obstruction amongst the men examined, I made many rhinological observations with practically negative results in the majority of cases. It cannot, of course, be argued that this respiratory inefficiency constitutes as yet a pathological condition; but there can be no doubt that sooner or later, unless steps are taken to re-educate the respiratory mechanism, ill-health of one sort or another must supervene. Be that as it may, there

can be no question whatever that staying power—one of the qualities to be most prized in a soldier—is seriously jeopardised, for endurance is directly related, yes, and directly regulated, too, by the respiratory organs. The cause of the defect pointed out is not difficult to trace, for it is nothing more or less than the strained position in which the soldier is made to carry himself, coupled with the erroneous assumption that all physical exercises tend sufficiently to develop the breathing powers. The study of the chest poise and respiratory mechanism of a runner going strong with his “second wind” will give us an idea as to what constitutes perfect respiration, for the so-called “second wind” is nothing more or less than Nature asserting herself; in other words, she has corrected man’s mistakes, so that the intense breathlessness which was before a prominent feature is now absent. The mouth is closed, and the air passes silently in and out through the nostrils, which dilate more or less with each inspiration. The head, with chin slightly drawn in, is carried erect, but not stiffly. The chest is prominent, but not unduly so, and the shoulders are held steadily down and comfortably back, whilst the back is flat, with the spine practically straight, *i.e.*, not curved in the lumbar region or elsewhere. The abdomen, as high as the waist, is retracted, the lower ribs at the back and sides move freely out and in, whilst the upper part of the abdomen, *viz.*, the pit of the stomach, is drawn in during each inspiration and flattened again in expiration. (There is a complete absence of that constrained position so beloved by the drill sergeant, in which the chest is rigidly held out by the shoulders being well drawn back and the back hollowed.) It should be observed that the antero-posterior diameter of the upper chest remains a constant factor; this is also a noticeable feature in the respiration of horses, dogs, and other animals. It is interesting to note that this poise of the chest is also to be seen in vocalists of both sexes who follow the traditions of the old Italian school of voice production, and is sometimes known to them as the *High Fixed Chest Method of Breathing*; and the good physique of the majority of singers, coupled with their excellent general health and immunity from tubercle of the lungs, speaks volumes for this method of respiration.

It may not be uninteresting to recall to mind the part played by the diaphragm in lower rib breathing. As is well-known, this muscle is attached to the spine behind, the sternum in front, and to the six lower ribs at the sides. And it has been shown by Duchenne that by its contraction alone this muscle can elevate the ribs to which it is attached, so long as the vault is supported by

the abdominal viscera. In other words, if the abdomen is retracted, the organs in its upper part are fixed in the arch of the diaphragm, the tendon being thus supported cannot be further depressed, therefore the muscular fibres in contracting elevate the ribs. When, however, the abdominal muscles are held in a more or less relaxed state the tendon is unsupported, and descends as the muscular fibres shorten in length, so very little, if any, rib movement takes place. It is this latter action of the muscle which is usually described in physiological works, and is mostly the one employed by the soldier when in the ranks, &c., as it is practically impossible for him to do otherwise even if he wished to, for with a more or less fully expanded chest and the super-erect carriage he assumes, or is made to assume, it is extremely difficult to obtain the proper diaphragmatic rib action.

Not only is it essential for the soldier to be taught the correct poise of chest and body, but it is quite as necessary for him to be given a clear idea of what actually takes place in breathing. To tell a man unacquainted with the facts, as is constantly done, "to take a breath and then let it out again," usually results in the performance of all kinds of unnecessary and incorrect movements, such as sniffing, gasping, lifting of the shoulders, &c. Seeing that no two men have the same build of body, it is hurtful to a degree to try and obtain with all alike that prominence of the chest which is so pleasing to the eye of the drill sergeant. With regard to the proper carriage of the soldier's body, both military and physiological requirements would be satisfied if the words *easily* and *without constraint* (which are to be found in the Manual of Infantry Training under the heading "Position of Attention") were borne in mind, and the ideas conveyed by these terms acted upon.

Large, coarse muscles are not required in a soldier, but liteness and lightness, coupled with powers of endurance. Huge muscles are of no use to any one except so-called professional strong men; but even they find to their cost sooner or later that they suffer from emphysema of the lungs, for it is not possible to lift great weights or practise exercises involving constant tension of the muscles without holding the breath, and a state is eventually reached in which it becomes very difficult, if not impossible, to altogether relax the tension of the respiratory muscles, even when not going through movements necessitating gripping or strain, and as the lungs follow the excursions of the chest wall, and are always in contact with it, they consequently remain more or less distended. A lesson to be learnt from the lower animals is that the best strength is that which is produced by natural habits; so if the

soldier were taught to breathe correctly, and this cannot be done unless the carriage of his body is physiologically sound, it can be confidently asserted that (given moderation in food and drink), with plenty of walking and games, such as cricket, football, hockey, &c., his physical condition would be as perfect as Nature intended it to be. Should, however, it be considered essential, for some special reason, that he must possess showy biceps, &c., care should be taken to prevent, as far as possible, the breath from being held during the muscle-moulding process, and for this purpose there is nothing more helpful than counting in a loud whisper.

In conclusion, I would suggest that all chest measurements be taken at or about the level of the seventh rib, as a more accurate record can be obtained here than elsewhere, owing to this being the base of the chest and the seat of the greatest mobility (from a mathematical point of view it is evident that in the expansion of a cone the diameter of the base is by far the most important diameter to be considered), and there are no large muscles that can be thrown into prominence to deceive one.

[NOTE.—Since forwarding the above article my attention has been called to a very interesting communication by Lieutenant-Colonel F. Arthur Davy, R.A.M.C. (R.P.), entitled, “A Contribution to the Etiology of Heart Disease in the Army,” which appeared as an Appendix to the Army Medical Department Report for 1876, and the paper is well worth the perusal of all army surgeons. By closely reasoned arguments the author shows that the usual chest swelling “setting up drill” insisted on in the army necessarily produces a disturbance of the balance which exists in health between the two circulations—the pulmonary and the systemic—which, when it does not eventuate in invaliding, causes great physical discomfort, breathlessness and discontent, and makes hard work very much harder still. As Colonel Davy very rightly says, it is nothing short of pitiful to see him (the soldier) trained to break down when the necessary “physique” might be secured by a little judicious padding instead of at the expense of the heart and lungs. And with regard more particularly to diseases of the nose, ear and throat, I can show that much of the good obtained from operative or other treatment, such as a correct method of breathing, &c., is not unfrequently nullified by the training a man is again subjected to on his leaving hospital, for disorganisation of the respiratory mechanism is followed sooner or later by the return of catarrh of the upper respiratory tract, and the evil consequences resulting therefrom.]

HINTS REGARDING THE MANAGEMENT AND USE OF X-RAY APPARATUS.

BY LIEUTENANT AND QUARTERMASTER F. BRUCE.

Royal Army Medical Corps.

(Continued from p. 270.)

Mackenzie Davidson's Localising Apparatus.—It is a well-known fact that where foreign bodies are embedded in deep tissue their location as shown on X-ray photographs is altogether illusory. The position of the foreign body, as seen on the plate, is entirely dependent on the direction of the rays; it is therefore possible by the adjustment of the anode to make the body appear as being situated far from its true position. Before the advent of the localising apparatus many mistakes were made through the non-appreciation of that fact, with the result that X-rays were held up to derision. However, this unsatisfactory state of matters suddenly ceased when it became possible to locate to a millimetre such articles as needles in any part of the human body. Mr. Mackenzie Davidson, in his original article on the subject, which appeared in the *British Medical Journal* on January 1st, 1898, states as follows: "It is not enough for the surgeon to have a fine photograph or a skiagraph of the part of the human frame showing the presence of a foreign body. He wants more than that to enable him to operate with complete confidence. He wishes to know the size of an object and its position and depth from the skin at any point he may select. The extended use of the X-rays has led to an increasing need for some simple method of localisation which can be at once readily carried out, and at the same time be reliable. The method I have devised I believe is of this character, and I have had an apparatus constructed which fulfils these requirements. It was, of course, obvious from the first that taking a skiagraph from two or more points of view was the necessary starting point to any method of localisation. But the question was, how the resulting photographs were to be dealt with to give the desired information as to the precise position of this foreign body. This remained a difficulty, except to the comparatively few who were sufficiently familiar with geometrical drawing and mathematics." The apparatus consists of a couch having two uprights for carrying a horizontal bar, from which the tube is fixed by means of a holder. The top of the couch is divided into five movable parts, to one of which are fixed the upright bars and also the receptacle for holding the plate during the exposures. This receptacle is in the form of a shallow box, with a tightly-stretched skin, drum-like cover, over which two wires

are arranged at right angles to divide it into four equal parts. The under part is in the form of a trap door to permit of the plate being placed in position below the wires, so that they will show on the skiagraph. The part to be taken is placed over the wires after the tube has been adjusted. The other part of the apparatus consists of a contrivance for reproducing the rays by means of threads when making the necessary calculations from the appearances on the negative.

The procedure in arranging the apparatus, taking the skiagraph and making the calculations, is as follows :—

Adjust the anode of the tube so that its centre is coincident with the intersection of the wires on drum. This can easily be done by the aid of two plummets having cords of equal length. Attach a hook to the free end of each cord for the purpose of suspending the plummets from the loops at the extreme ends of the tube, the latter having previously been placed in position in the holder with its axis parallel to the plate holder. By means of the holder, adjust the position of the tube so that the plummets hang directly over the wire situated at right angles to the couch. Standing at the end of the table, and by the aid of a plumb-line, carefully bring line, centre wire and anode into one line by moving the tube-holder. When making this adjustment, the plumb-line should be held at the full extent of the arm, and at least three feet from the end of the table. The height of centre of anode from plate must now be ascertained. Personally I use the plumb-lines which were suspended from the ends of the tube to arrive at this measurement by making them of a given length, usually about twenty inches, and as the centre of anode is situated in the axis of the tube the distance thus obtained must be approximately correct. The position of the tube-holder, as indicated on the scale on the horizontal bar, should be noted. A stop is now fixed three centimetres from either side, when the tube-holder can be drawn aside to permit of the patient being placed on the table without risk of deranging the adjustment of the tube.

Having decided on the part which is to rest on the plate, the latter is placed in position under the cross wires and the trap-door firmly secured. It is usual to make a screen examination to find out approximately the position of the foreign body, so that the part in which it is situated may be conveniently placed on the drum. A small coin is placed on one of the quadrants and a mark made on the skin immediately above it. The tube-holder is now brought close up to the fixed stop and secured. The centre of anode is thus three centimetres from the central adjustment. The first

exposure is then made, and the patient warned not to move. Move the tube-holder along the bar six centimetres, secure, and make second exposure. Note that the anode was three centimetres on other side of central adjustment when the last exposure was made.

On the patient being removed from the drum it will be found that the skin bears the imprints of the wires. With a piece of nitrate of silver mark the skin at the extremities of the imprints, also the part which lay in the same quadrant as the coin. Nitrate of silver is recommended, because, during the process of preparing the part for operation, ink or other marks would be obliterated, in which case another localisation would be rendered necessary. Before taking parts such as the palm of the hand, which would not show imprints of the wires, smear the latter with a good quantity of ink, such as is used for rubber stamps, not neglecting to use nitrate of silver in the same manner as before described.

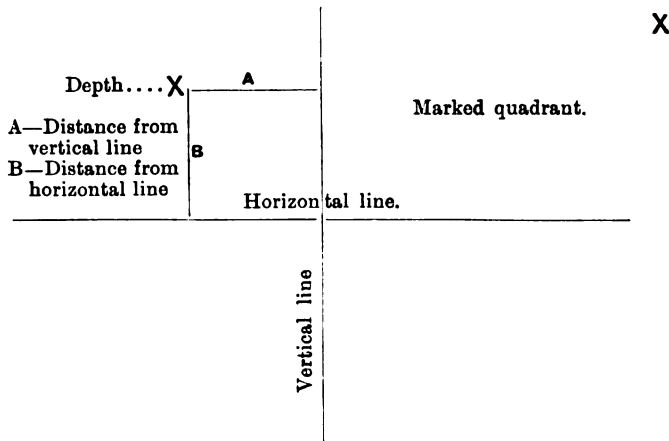
Develop, fix and wash the plate; and should immediate localisation be required immerse the plate in a formalin bath, when it can be quickly dried.

Prepare cross thread apparatus, the height of the gibbet from glass plate to be the same as centre anode from drum.

On a sheet of foolscap paper rule two lines at right angles to correspond with those shown on the negative, and mark one of the divisions to also correspond with the marked quadrant on the negative.

Place the negative on the glass square with the lines representing the cross wires over the marks cut on the surface of the glass. As there is a right and a wrong way in doing this, it should be understood that when standing in front of the apparatus the line facing the operator corresponds to the wire on centre of couch and is sometimes termed the vertical line, the other at right angles the horizontal line. As the displacement in taking the skiagraphs was lateral, it follows that when the negative is correctly placed on the glass, the images should show displacement in the direction of the horizontal line. Lower the mirror until the negative is brightly illuminated. Next take one of the metal weights, to which a needle is attached by a screw. A piece of silk thread is secured to the body of the weight and the other end passed through the eye of the needle. Conduct the thread through one of the slits in the gibbet and over the pulley at the same side of the standard and fix the counterweight. The other weight and thread is arranged in like manner over the opposite slight slit and pulley. The slits are six centimetres apart, hence care must be taken that the displacement of the tube should not exceed that distance. Cross the threads and place the eyes of the needles one on each of the two images.

By means of the surface gauge the height from plate to intersection of the cross threads is ascertained. This height represents the distance the foreign body is under the skin, and should be carefully noted down. Next measure the distances between the point where the threads cross and the vertical of the vertical and horizontal lines. Place the upright square, with its lower edge coincident with the vertical line, and by the aid of a pair of compasses measure the distance between the intersection of the threads and square. Next place the upright square against the horizontal line, and measure off the distance from the cross threads in the same way as for the vertical line. These measurements should be carefully noted down and a diagram prepared as follows :



Before attempting to localise a foreign body in any part of the human frame, it is strongly recommended that a few experiments be made on needles embedded in turnips or in loaves of bread, in order that the procedure may be fully understood. The absence of the most careful attention to detail may cause the surgeon to operate in a wrong quadrant. As a preliminary before the operation I invariably place the negative over the part, film downwards, in order to prove position of marked quadrants.

As regards the question whether it is necessary to use a fresh plate for each exposure, much will depend on circumstances. For the extremities, the two exposures can be made on one plate without suffering any inconvenience from fogging. Many operators invariably use two plates, but this I have never found to be absolutely necessary except when localising needles in deep tissue. In South Africa I never used more than one plate for bullets situated in any part of the body.

Clinical and other Notes.

A CASE OF OBSTRUCTION OF THE SUPERIOR VENA CAVA BY MEDIASTINAL NEW GROWTH.

BY MAJOR C. E. G. STALKARTT.

Royal Army Medical Corps.

MAJOR G. P., Royal Engineers, came under observation at St. Helena on February 2nd, 1905, when he complained of sore throat, and was found to have some follicular tonsillitis.

On February 4th his condition was as follows: temperature 99° F., pulse 76; his whole face was swollen up and œdematous-looking, the lower eyelids being affected, also the superior maxillary, the parotid and the submaxillary regions; there was also some thickening of the neck generally, and the back of the throat and the fauces were congested and relaxed. The urine was of high specific gravity and contained no albumen or sugar.

Previous History.—The patient stated that he had not felt well since about the middle of January, 1905, and about the 20th of that month he had some retching and vomiting owing to a peculiar sensation in his throat, and for which he could not account. Subsequently, he had a feeling of "being gripped in the throat and neck," and which got gradually worse. Under treatment in bed the swelling of the face and neck gradually subsided, and the condition was practically normal on February 28th, 1905, when the patient was allowed to get up.

On March 4th, 1905, it was noticed that the face had again commenced to swell up, and on March 5th the eyelids were markedly œdematous, as well as the whole of the face; the neck was much thickened, and the swelling extended down to the subclavicular regions in front and to the shoulder blades at the back.

On March 6th, 1905, the condition of the swelling was unchanged; the fauces were much relaxed, and the uvula thickened and elongated; the voice was very husky and a dry cough was present. The superficial veins over the neck, and of the upper part of the chest in front, and of the shoulders behind, were dilated and filled from above downwards. The urine had a specific gravity of 1025; no albumen or sugar. The temperature was 98° F.; the pulse was 60 and regular; the heart sounds were difficult to hear in the recumbent posture, but the rhythm was unaltered; the second sound was barely audible in the aortic and pulmonary areas, both radial pulses beat synchronously; the cardiac dulness was marked by resonance over the precordia. The percussion note was found to be impaired over the right subclavicular region at the inner third of

the clavicle (extending about one and a half inches downwards and outwards from the sternal notch), and the respiratory sounds over this area were diminished; the lungs presented no further abnormality. Slight breathlessness was complained of on exertion, but there was no pain. The liver, spleen, and intestines were normal, and there was no swelling of the arms or legs. Under treatment some amendment occurred, with partial subsidence of the swelling of the face and neck. A diagnosis of obstruction to the superior vena cava having been made, probably caused by a malignant new growth, the patient was invalided on March 15th, 1905, and sent to England.

The subsequent history of the case (for which I am indebted to Dr. Milner, of Parkstone) is as follows: On arrival in England (April, 1905) the patient had some paroxysmal cough with slight hæmoptysis and some dyspnœa. There was no pain, but a vague sense of oppression in the region of the right clavicle. The superficial veins of the neck and upper part of the chest were enlarged, and some fulness was present with dullness on percussion over the right clavicle and the manubrium sterni. The breath sounds were diminished over the right apex. The face was slightly puffy. The X-rays showed a definite shadow in the region of the right apex.

His condition remained much the same until about June 20th, 1905, when he began to suffer from further symptoms of pressure on the large veins at the root of the neck and over the trachea, which gradually got worse, and the patient died on July 6th, 1905.

CHROME LEATHER—A SUITABLE MATERIAL FOR SOLDIERS' BOOTS.

BY LIEUTENANT-COLONEL R. KIRKPATRICK, C.M.G.
Royal Army Medical Corps.

WHILE I was serving in India, some two years ago, the Madras School of Art sent out circulars enclosing samples of chrome leather manufactured at Madras by the school. This is a Government school which takes a lead in introducing and popularising any technical work or manufacture likely to be a benefit to the natives of Southern India. I received one of the samples and had a pair of shooting boots made of it. The following is a short note of my experience of its use:—

I found the leather to be so much superior to ordinary shoe-leather in quality and durability, that I think it might with great advantage be tried in the making of soldiers' boots. A comparative test at a *dépôt* or in a company would, however, enable one to form a better opinion on its suitability for army boots. The following points recommend the leather.

It is more pliable than ordinary leather, and as it is almost water-proof it retains its pliability much longer than ordinary leather. In wet weather it does not become sodden. It dries rapidly, and when dried does not become stiff, so as to require frequent applications of dubbin, a material which the soldier does not always appear to possess. It is much more durable than ordinary leather and stands the roughest wear well. It is about one third lighter than ordinary leather, and this difference in weight becomes very appreciable on a long day's march. I have not been able to ascertain the comparative cost, but from the School of Art's circular I judge that any difference in cost is in favour of the chrome leather, as the time taken in the process of tanning is shorter, while the material used is of about the same cost. The test suggested above would determine this point also.

THE TREATMENT OF GONORRHOEA.

By CAPTAIN N. E. HARDING.

Royal Army Medical Corps.

FAMILIAR as the Army Medical Officer is with gonorrhœa and all its complications, it is to be regretted that he does not more often use the method of treatment introduced by Janet, and popularised in Great Britain by Swinford Edwards. Syringing, as ordinarily practised, is almost valueless, and, indeed, the fluid probably does not penetrate more than four inches down the urethra. Drugs, such as cubebs, copaiba, sandal-wood oil, urotropine, saw palmetto, and methylene blue, are generally expensive, often nauseating, and, in my experience, usually useless.

The general treatment I adopt is to keep the patient in bed and on milk diet for the first week or ten days, until the discharge has much lessened and become gleety, and the risk of orchitis and bubo has greatly diminished. He is given a mild saline purge every morning, and his urethral canal is well flushed out by giving him a saline diuretic such as acetate of potash with buchu and hyoseyamus, and by encouraging him to drink large quantities of barley water and hot water. The requisites are a douche-can, holding a pint, with eight feet of rubber tubing attached to a glass nozzle, just big enough to penetrate the meatus for half to three quarters of an inch; those ordinarily sold are much too small, and it is best to procure them direct from Montague of Bond Street. As regards the irrigating fluid, I have no experience of the more expensive ones, such as nargol, albargin, and protargol, but very good results can be got with potassium permanganate. It is convenient to keep a stock of 1 per cent. solution of this, and to begin with a quarter-ounce to the pint, or 1-8000. The patient, having first emptied his bladder, sits down on a low stool, with a vessel in front of him, and

loosely introduces the nozzle into the urethra, allowing the fluid, at about body temperature, to flush out the anterior urethra thoroughly, and escape into the vessel. By gently compressing the lips of the meatus on the nozzle, the pressure can be so adjusted that the anterior urethra only is distended, and in ordinary cases this is all that is needed, and indeed, all that is possible at first, on account of pain. Should the posterior urethra unfortunately be involved, the meatus is firmly compressed on the nozzle end at the height of from four to six feet; as a rule the resistance of the sphincter is overcome, and the fluid passes into the bladder. As much is allowed to flow as can be held, and then the patient rises and passes it. The strength of the solution can be gradually raised up to a maximum of about 1-4000 if passed into the bladder. The first time it is necessary to do this for the patient, and then he should be supervised once or twice; but after that he can be trusted to do it for himself. It will be found that much better results are got by using weak solutions frequently, say every four hours, and, as far as possible, at equal intervals over the day, than by using stronger ones less frequently.

It is not suggested that this method will cure a chronic prostatitis or a bad stricture in a day or two, but I think it will be generally found that a man can be cured in much less time than is usually the case in our hospitals.

TWO CASES OF BLACKWATER FEVER.

BY CAPTAIN HOWARD ENSOR, D.S.O.

Royal Army Medical Corps.

CASE 1.—Private S. S., a soldier of the Egyptian Army Veterinary Department, was admitted to the Station Hospital at Wau, Bahr-el-Ghazal Province, Anglo-Egyptian Sudan, on October 25th, 1905, complaining of vomiting and of severe pains in the head and limbs. On admission his temperature was 101° F., and to all appearance he was an ordinary case of malignant tertian fever, which is fairly common at Wau, particularly among the Egyptian troops. His spleen was considerably enlarged, but not tender on palpation. He had served for fifteen months in the district, and his medical history sheet showed six admissions to hospital for malarial fevers during that period. A purgative, to be followed two hours afterwards by quinine bisulph., gr. x., was prescribed for him, and the quinine ordered to be repeated in the evening. At 6 p.m. of the same day his temperature had risen to 104° F., and he complained of feeling very ill, but he presented no symptoms calculated to cause anxiety. Early on the morning of October 26th it was reported to me that his condition had changed for the worse, and that he appeared to be dying; on proceeding at once to the hospital his condition was found to be as follows: Temperature 99° F., skin moist and cool, pulse

weak and scarcely perceptible, and his breathing quick and shallow, with occasional yawning. Closer examination revealed the fact that his conjunctivæ had become of a distinct yellow colour, and that his spleen was distinctly more enlarged than it had been on the previous day, and was also very sensitive to pressure. These facts, together with the previous history of high fever, &c., made it very probable that the man was suffering from blackwater fever, and on asking the man to pass water the diagnosis became immediately established. The Egyptian sergeant in charge of the night duty party, on being questioned, reported that the patient had been very uneasy all night, had vomited several times, and had also passed water frequently. He had not noticed that the urine had become black, but this was excusable as the wards in Wau Hospital are but dimly lighted at night, and the urine had been removed before daybreak. The following treatment was then carried out: The patient was well wrapped up in blankets, with hot water bottles to the feet, half an ounce of brandy was given at once and ordered to be repeated every four hours, accompanied by 10 min. doses of tinct. digitalis. Hot milk, beef tea, and Brand's essence of beef were ordered to be given frequently in small quantities at a time, so as not to excite vomiting. The strictest orders were given to entirely stop the administration of quinine, no medicinal treatment, beyond the digitalis previously mentioned, being attempted. Four films of blood were taken from the patient's ear and stained by Leishman's method, but no malarial parasites were found after prolonged search. The urine was examined microscopically for red blood corpuscles, but none were seen, and some hours afterwards the sediment was also examined for the ova of bilharzia, with a negative result. This was done to preclude the possibility of the bloody urine being due to bilharzia, although it was really unnecessary, as the absence of red blood corpuscles had already proved that the colour of the urine was not due to hæmorrhage consequent on bilharzia ova piercing the bladder wall. After six hours the patient's condition had much improved and he stated that he felt much better, and was in fact in no immediate danger. He was also passing urine freely, and by the evening the blood colouration had greatly diminished. The temperature at 6 p.m. was 98.4° F., the pulse 72, and the yawning, indicative of a deficient supply of oxygen to the respiratory centre, owing to the destruction of red blood corpuscles, had entirely ceased. This yawning had been a well-marked symptom in the morning. The patient had vomited once during the day, but had retained most of the nourishment given him. The bowels had been moved twice; the stools, however, presented nothing distinctive. The brandy was ordered to be given every six hours instead of four, and no further change made in the treatment. The next morning, October 27th, at 9 a.m., the patient was still improving, the temperature was 98° F., and he had slept some hours during the night. The total quantity of urine, which had been collected from 9 a.m. of the previous day was forty-

two ounces. Freshly passed urine still showed the presence of hæmoglobin in small quantity; the condition of the spleen was unchanged, and no enlargement of the liver could be made out. A mixture containing liq. ammon. acetatis and spt. chloroform, was ordered as a diaphoretic, but after careful consideration it was decided to continue the brandy as before. The diet was left unchanged. At 6 p.m. the patient's temperature was 99° F., and he was quite cheerful, and had taken nourishment well during the day. Examination of a freshly-passed sample of urine showed the specific gravity to be 1015, the reaction acid, and albumen to be present in considerable quantity. The urine was bright and clear and contained no hæmoglobin. The peripheral blood was examined but no malarial parasites were seen.

October 28th.—Temperature normal; patient had slept practically all night, and had no bad symptoms of any kind. Total quantity of urine passed in twenty-four hours, thirty ounces. The urine showed a trace of albumen with the nitric acid test. The brandy was reduced to half an ounce every eight hours and the same diet continued. The blood contained no malarial parasites. Evening temperature 98·4° F. The tenderness on palpation of the spleen was much less, and the organ itself was reduced in size.

October 29th.—Morning temperature 97·6° F., evening 98·6° F. Total quantity of urine passed in the preceding twenty-four hours, twenty-six ounces. No albumen could be detected in the urine. Benger's food was added to the diet and the brandy discontinued. No malarial parasites could be found in the peripheral blood.

October 30th.—Morning temperature 97·6° F., patient very well indeed and complained of being very hungry; three eggs ordered in addition to milk and Benger's food. Total quantity of urine for twenty-four hours, thirty ounces. No albumen, and no malarial parasites could be found in the blood.

October 31st.—Morning temperature 98° F., evening 98·4° F. Total urine passed in twenty-four hours, forty ounces, which is about the normal quantity for a tropical climate. Half a pound of bread was added to the diet, and a tonic containing arsenic and iron in small doses was ordered to be taken three times a day after food. From this date to November 7th, when the patient was sent down to Khartoum with a sick convoy, he made uninterrupted progress towards complete recovery, and I have no doubt is now entirely restored. Fortunately, owing to the time of the year, the rivers being full, the sick convoy was able to proceed to Khartoum entirely by steamer, *via* the Jur and Bahr-el-Ghazal Rivers to the White Nile and so to Khartoum.

CASE 2.—Yuzbashi (Captain), I.M., an Egyptian officer of the 9th Sudanese Regiment, was admitted to the hospital at Wau on November 11th, 1905, suffering from fever and vomiting. On examination, his temperature was 101° F., and he complained of the usual pains in the

head and limbs, and of the vomiting which is so constant a symptom of malignant tertian fever. His spleen was much enlarged, and he stated that he had had several attacks of fever during the twelve months he had served in the Bahr-el-Ghazal Province. On the evening of the same day his temperature had fallen to 99·5° F., and the vomiting had ceased; he said he felt much better and was able to take milk and beef tea. He had been given 10 gr. of quinine soon after admission in the morning, and a similar dose was given to him at 8 p.m. At about midnight he was again ill and sent for the Orderly Medical Officer, an Egyptian, who took his temperature and found it to be 103° F. Warned by the previous case, he examined the urine passed by the officer and found it to be black with hæmoglobin. The same stimulant treatment as given to the previous case was at once begun, and in the morning the patient's temperature was normal and his condition such as to cause no immediate anxiety. The urine was still black but rapidly cleared in the course of the day and was quite clear by the evening. The urine was examined for red blood corpuscles and bilharzia ova with a negative result, and the peripheral blood failed to show malarial parasites after prolonged search. Vomiting was a troublesome symptom at first, but a full dose of tinct. chloroformi et morphinæ had the effect of speedily controlling it.

November 13th.—Temperature 97·8° F., patient had slept fairly well; the urine was clear but contained a trace of albumen. Treatment identical with previous case. Evening temperature 99° F.

November 14th.—Temperature normal, urine contained no albumen. The case proceeded to convalescence and was treated in the same way as the one already described, and on November 24th this officer proceeded to Khartoum on three months' sick leave. During the treatment of his case the temperature never rose above 99·2° F., after it had become normal on the morning of November 12th, and not a grain of quinine was given after the diagnosis of blackwater fever had become manifest. The case presented practically no symptoms of collapse, probably because stimulant treatment was commenced early in the disease.

The generally accepted opinion of the cause of blackwater fever is that it is in some way due to the action of the plasmodium of malaria, but this opinion is undoubtedly beginning to lose ground among medical men to whom the disease is familiar. A case which came under my care in Northern Nigeria, in 1898, certainly seemed to show that the two diseases have nothing in common. A British N.C.O. was admitted to Hospital at Lokoja, Nigeria, suffering from blackwater fever. Many microscopical examinations of his blood were made, but no plasmodia discovered. The case was treated without quinine, and, as is usual in a young and healthy man, he made a quick recovery. While convalescent he was attacked by typical malarial fever, his blood was examined and found to contain the benign tertian parasite in great numbers. The usual quinine treatment

was given and the patient rapidly recovered. In this case, although a week had not elapsed since the hæmoglobinuria had ceased, there was no return whatever of the "blackwater." Surely it is only reasonable to suppose that if blackwater fever was in any way dependent on malaria, the occurrence of an attack of malaria so soon after recovery from blackwater fever would cause a recurrence of the symptoms of the last-named disease. The question as to the existence of malarial parasites in the peripheral blood is a very vexed one, but probably the bulk of opinion of medical men familiar with the disease, and also familiar with the malarial parasite, would be on the side of those authorities who say that it is but rarely found in cases of blackwater fever. Cases are often reported in which the blood in so-called cases of this disease was found to contain parasites, and the presence of these parasites is vouched for by authorities whose opinion must be taken as absolute. In many of such cases it may possibly be found that the cases themselves were not seen by the authorities who examined the blood, but that films were sent to them for examination, and these so-called cases of blackwater fever were in reality cases of bilious remittent fever, wrongly diagnosed by inexperienced physicians who had been deceived by the deep bile colouration of the urine; such a mistake is very easy to make when cases of this character are seen for the first time. It is quite common to hear old residents in districts where blackwater fever occurs, airily declare that they have had the disease four or five times, and the young inexperienced physician is not infrequently called in by such people to find the diagnosis has already been made for him by his patient, and dark-coloured bilious urine is shown him in proof of this ready-made diagnosis. Such cases are treated with large doses of quinine with the best results, and in this way genuine cases of blackwater fever are also given quinine in big doses with anything but good results in very many instances. Blood films from the two cases described above were sent to Dr. Andrew Balfour, the head of the Research Department of the Gordon College, Khartoum, an authority whose opinion will be unquestioned, and he reported that in no film could the malarial parasite be found after prolonged search. To the ordinary observer the microscopic examination of blood, more especially fresh blood, from cases of blackwater fever, is full of difficulties; the number of rifts, vacuoles of a peculiar shape, and deformities, seen in blood corpuscles from cases of this kind, being enormous, and calculated to deceive everyone except the elect. It must, of course, be admitted that malarial parasites can be found in the peripheral blood in some few cases of blackwater fever, but their presence can be accounted for as accidental and not as having any real relation with the causation of this disease. The opinion is also given in many text-books that blackwater fever usually only occurs in those Europeans who have resided for lengthy periods—about a year—in malarial districts, and are debilitated in consequence of numerous attacks of malaria. My experience of black-

water fever is practically confined to soldiers, and in 1898 several cases of this disease came under my observation among the British officers and N.C.O.'s of the West African Frontier Force serving in Northern Nigeria, who had not completed six months' service in the colony, and who could not fairly be described as debilitated. The best and most convincing argument of all in favour of blackwater fever being a disease distinct from malaria is, perhaps, to be found in the fact that in India, where malarial fevers are both common and severe, blackwater fever cannot be said to have been proved to exist. With regard to locality, as far as my own experience goes, blackwater fever seems to me to occur with greater frequency in districts which are more or less free from swamps than in districts where swamps are the prevailing feature of the landscape. Medical men in Nigeria will, I believe, agree with me that blackwater fever is more common in Northern Nigeria, where the country is more or less open and the soil dry and rocky, than it is in the Niger delta, which is a network of waterways, separated from each other by swamps and swarming with mosquitoes. Blackwater fever is certainly more common as regards the Nile Provinces of the Anglo-Egyptian Sudan, in the, for the most part, hilly and beautifully wooded province of the Bahr-el-Ghazal, than in some of the districts of the White Nile, where swamps comprise great part of the scenery, and the mosquitoes, to put it mildly, are very plentiful. In these swampy districts malarial fevers of all kinds are very common, but blackwater fever is certainly rare.

With regard to treatment, the opinion of all the older text books is that heroic doses of quinine should be given to cases of this disease, but, fortunately, now most text books confine themselves to giving practically no definite opinion at all on the subject, but simply remark that large doses of quinine are given by many, intermediate doses by some, and none at all by others. This is disappointing to the physician who finds himself confronted with a case of blackwater fever for the first time, and reads up all the literature on the subject in his possession, so that his patient may have the best possible treatment. The treatment, as sketched in the above two cases, is perhaps the best possible, and, I believe, is the treatment now used by the majority of practitioners of experience. Every case must, of course, be treated on its merits as regards the administration of stimulants, but it ought to be regarded as a rule that no undoubted case of blackwater fever should be given quinine in large doses. Any drug more likely to do harm in heroic doses during the stage of collapse, which usually sets in with the fall of the temperature to normal or sub-normal about thirty hours after the commencement of the initial fever, can scarcely be imagined. In my opinion the proper way of treating all cases of blackwater fever is by early and continued administration of stimulants and liquid nourishment as long as any symptoms of collapse remain, and afterwards by careful attention to the

kidneys. In fact, after the patient has been tided over the stage of collapse, the case resolves itself practically into one of acute nephritis, and should be treated accordingly. The blood should be examined daily, and if malarial parasites are found quinine in moderate doses should be given; the occurrence of parasites in the circulation should be looked upon as a complication of the disease, and the temptation to treat the case with large doses of quinine should be withstood. Up to the present ten cases of blackwater fever have come under my direct care or observation, and of these cases only one has resulted fatally, none of them having been treated with large doses of quinine. In my opinion blackwater fever occurring in a young subject with healthy organs should not be looked upon as a very deadly disease, and a good prognosis can be usually given as regards the probability of complete recovery.

KALA-AZAR, AND ITS INTERMEDIATE HOST. A SUGGESTION.

BY CAPTAIN S. L. CUMMINS.

Royal Army Medical Corps.

IN the search for the intermediate host of the Leishman bodies, one peculiarity, distinguishing them from blood-parasites transmitted by suctorial insects, deserves close attention. These bodies are practically never found in the peripheral circulation.

Bearing this fact in mind, it seems reasonable to ask by what means a parasite, confined to the portal area, may be transmitted from man to man. As the peripheral circulation is liable to be tapped by suctorial insects, so is the portal area at the disposal of intestinal parasites. The suggestion which I venture to put forward is that, in one of these, the carrier and intermediate host of the Leishman bodies may be found.

To such a suggestion, a necessary corollary is that the "bodies," when taken into the intestinal canal of the worm, gain the ova, leave the body in the embryos, and are thus in a position to regain the human host with the infected worm. There is nothing impossible in this. The researches of Dutton and Todd, recently confirmed by Koch (see article in the *British Medical Journal*, March 24th, 1906), show that the spirochæta of African relapsing fever, on being sucked into the intestine of a tick, reaches the ovaries, exists in the eggs, and finally appears in the young ticks hatched from them.

That parasites of this nature can pass a stage in worms is supported by a sentence which I quote from Lieutenant-Colonel Birt's interesting article "The Leishman Body, the Gregarine Stage of a *Herpetomonas*," in the *ROYAL ARMY MEDICAL CORPS JOURNAL* for June, 1906. "Butschli discovered a monodine much like the above (Burnett's *Herpetomonas*) in the intestine of a free Nematode, *Trilobus gracilis*."

In searching amongst the Vermes for possible hosts, many can be at

once excluded. The Cestodes may be eliminated as having no alimentary canal, or only an incomplete one. The Trematodes are unlikely to furnish the looked-for intermediate host, as they seem to be little known in man, with the exception of the *Bilharzia hæmatobium*, whose life history is not yet completely worked out, and the worm-stage of which is not passed in the intestine. It is amongst such of the Nematodes as inhabit the digestive tube that we are likely to find the culprit, and to my mind, the evidence goes far to incriminate the *Ankylostomum duodenale*. It has been, I believe, asserted that this parasite does not suck blood, but browses on the duodenal epithelium. This may or may not be the case, but does not put the hypothesis out of court, as the kala-azar bodies have been found on the surfaces of intestinal ulcers, and are known to exist in large numbers in endothelial cells. The evidence which seems to inculcate the *Ankylostomum* may be summarised as follows: (1) The similar geographical distribution of ankylostomiasis and kala-azar; (2) the large number of kala-azar patients who simultaneously harbour ankylostomes; (3) the fact that Giles and others, for some time, believed the diseases to be identical.

Against this view, however, I quote a letter from Lieutenant-Colonel Leishman, to whom I am indebted for his opinion on the subject. "It is by no means impossible that some intestinal parasite might prove to be the long-sought for host of the kala-azar bodies. At the same time I think the bulk of the evidence is against the *Ankylostomum* being such a host, for, although the geographical distribution is much the same, it is abundantly proved that cases of kala-azar occur in places where there is no ankylostomiasis, and further, many cases have been watched both during life and after death with completely negative results as regards *Ankylostomum duodenale*. Still, this does not necessarily mean that, in the early days of the disease, such an infection may not have occurred and not have been recognised."

In conclusion, I wish to state that my suggestion is put forward, with all diffidence, as a suggestion merely, and in the hope that it may be put to the test by someone who has cases at his disposal.

The disease is of such importance, and its mode of transmission so obscure, that I make no apology for calling attention to a possible line of investigation.

STERILITY OF MERCURIAL CREAM.

THE treatment of syphilis by the intramuscular injection of mercurial cream is now being so extensively carried out that any information as to the sterility of the present cream, as well as any particulars as to how far the cream will allow pathogenic germs to live or multiply within it, must be of considerable general interest.

The formula in use is the following:—

Metallic mercury 3 i by weight.
Wool fat 3 iv.
Liquid paraffin to 3 x. } by volume.

An ordinary supply sample of this cream was accordingly submitted to the Professor of Pathology, Royal Army Medical College, and he was asked to report: (1) Whether the cream was sterile? (2) whether pathogenic germs could live in it, if so, for how long? (3) whether pathogenic germs could propagate in it?

The following replies were received:—

- (1) The cream proved sterile.
- (2) Pathogenic germs will not live in it; the following organisms were tested, and died within twenty-four hours—
 - (a) *Staphylococcus pyogenes* in aerobic cultures.
 - (b) *Bacillus tetani* in anaerobic cultures.
- (3) Pathogenic germs will not propagate in it.

A CASE OF SMALL-POX.

BY LIEUTENANT-COLONEL C. T. BLACKWELL.

Royal Army Medical Corps.

SMALL-POX is epidemic in Hyderabad (Sind) City and district, the type of disease is severe, and there have been many deaths amongst the natives. In the cantonment the disease is not so prevalent, and is of a mild type, and there have been no deaths other than the one now recorded. Soldiers bearing insufficient marks of vaccination have been revaccinated, and natives whose business brings them in contact with Europeans, and who did not bear good marks, have been also revaccinated. The garrison consists of two batteries Royal Field Artillery, two companies British Infantry, and one native regiment.

Gunner H., of 47th Battery Royal Field Artillery, was admitted on Sunday evening, April 16th, 1905, and was placed in the "Detained Ward"; he called the attention of the assistant-surgeon to a rash on his body; the assistant-surgeon told me the following morning that the rash had been like that of measles. The next morning I saw the patient. He had a profuse petechial rash on abdomen, extending on to the flanks; he had also a profuse papular rash on forehead, but with very little discolouration. He complained of very severe pain in the small of the back, not relieved by position, typical of the disease. He was at once, with his bed, &c., removed to the isolation block. He had five good marks of vaccination on right arm, and three good marks of revaccination on his left arm; the latter were done in 1902. In two days the petechial rash disappeared, the small-pox rash on face, feet and hands, became confluent, and on the body very nearly so.

On April 23rd the patient became delirious and very troublesome ; he was with difficulty controlled by the native attendants, and two volunteers from the battery were kept in waiting to assist should the patient get beyond the power of the native attendants. He presented the usual loathsome spectacle of very severe small-pox, and the odour was most offensive.

On April 27th he again became conscious, the pustules gradually dried, and he seemed in a fair way to recover ; but his pharynx was badly ulcerated, and the superficial structures on the plantar aspect of his feet sloughed.

On May 2nd he expressed himself as not feeling as well, and the next day he was weaker, with hurried, shallow respirations ; he gradually got weaker and died in the evening of May 4th.

The case seems worthy of record in that he had five good marks of vaccination and three of revaccination, the latter dating from 1902, yet in three years his powers of resistance had been exhausted. It points to the truth of the book axiom that in times of epidemic it is safer to be revaccinated. It is not known how he contracted the disease. The city of Hyderabad is "out of bounds" for troops, and the patient on being questioned as to whether he had been in the city a fortnight before said he had not, but his manner of saying so gave me the impression that he was not speaking the truth. It was disappointing that he should die after having apparently got to an almost convalescent stage, for his death did not occur until the nineteenth day of disease, and during the most loathsome part of his illness he had been nursed extremely well by the native attendants. Had the season been less exhausting possibly the patient would have recovered, for, on the day he died, the thermometer in the hospital north verandah registered 112° F. in the shade, and this temperature alone requires some strength to combat. It would be interesting to know the opinion as to whether it was a particularly virulent strain of small-pox microbe in this case that was able to overcome the resistance of a man who apparently was so well protected ; or was it that the power of immunity of the man had become completely lost since 1902 ? I leave the question to be answered by one more qualified to give an opinion than I am, but the latter would seem to be the case, as none of the attendants contracted the disease ; they had either good marks of vaccination or had had small-pox, but had not recently been revaccinated. This is the only case that occurred in the 47th Battery, and only two cases, both very mild, occurred in the 32nd Battery. The medical history sheet of the patient is interesting as showing that he was a very vulnerable man, for, in less than three years, he had five entries for severe illnesses. Pleurisy twenty-nine days, bronchitis thirty-two days, epistaxis seven days, pemphigus twelve days, small-pox eighteen days.

June 30th, 1905.—No case has since occurred in cantonments, and the epidemic in the city has nearly ceased.

INNOMINATE ANEURYSM. SIMULTANEOUS LIGATURE OF
RIGHT CAROTID AND SUBCLAVIAN ARTERIES. RECOVERY.

BY MAJOR H. N. DUNN.

Royal Army Medical Corps.

PATIENT, H. S., an ex-soldier, aged 40, single, contracted syphilis in 1886, when he was under treatment for some weeks. Early in July, 1904, he suffered from severe neuralgic pains, radiating from the right side of the chest to the back of the head, and extending into the right shoulder. He attended at the out-patient department of the Arsenal Hospital, Woolwich, but no physical signs were, apparently, present at the time. On September 27th, 1904, the pains being more severe, he again presented himself at the hospital, and when seen by me, a well-marked pulsatile swelling occupied the episternal notch, and extended from the sternal origin of the left sterno-mastoid muscle to the junction of the inner and middle thirds of the right clavicle. The tumour measured three and a half inches laterally, and projected upwards above the clavicle for one and a quarter inches, the lower margin being ill-defined; well-marked expansile pulsation with a systolic murmur being present. The trachea was displaced to the left; dyspnoea on exertion or assuming the prone position and dysphagia on swallowing solids were also complained of. He suffered from severe pains along the right side of the head and neck and right shoulder and arm, the radial pulse on the right being also smaller than that of the left side, and its rhythm somewhat delayed. His voice was reduced to almost a whisper, and his cough "brassy" in character, the right vocal chord being fixed and motionless, due to direct pressure on the recurrent laryngeal nerve, but no "tracheal tugging" was observed. As the man was exceedingly ill and the tumour enlarging rapidly, Mr. Bidwell, of the West London Hospital, kindly saw the patient and confirmed the diagnosis of innominate aneurysm. The case was admitted to the Royal Arsenal Hospital, and put on a modified Tufnell's treatment, and large doses of iodide of potash (30 to 50 grains), administered three times a day. An attempt to get an X-ray photograph of the tumour was unsuccessful. For the first few weeks after admission marked improvement, due to the rest and dieting, took place, but as the tumour subsequently increased in size, operation was decided upon. With Mr. Bidwell's assistance the right common carotid was ligatured above the omohyoid muscle and the subclavian tied in its third stage; the patient being a man with a long spare neck, there was no particular difficulty about the operation, the subclavian being easily reached below the clavicle, as suggested by Mr. Bidwell, by elevating the shoulder; both arteries were apparently healthy at the site of ligature, and double strands of silk was the material used. Both wounds, with the exception of one small stitch point, healed without suppuration. His temperature rose to 99·6° F. on the day following the operation, and fluctuated between that and

normal until the fourteenth day, when it finally settled down to normal. He complained of severe pain along the right arm, but no œdema took place, nor did any head symptoms occur. Immediately after ligature of the arteries a decided diminution of the sac took place, and that portion in the episternal notch became firmer and less expansible, but subsequently the remainder of the tumour enlarged slightly upwards and outwards and pulsated somewhat more freely than before ligature. The following was his condition on March 29th, fifty-one days after the operation: That portion of the sac in the episternal notch has consolidated and feels firm to the touch, although faint pulsation is still felt and the sac itself is tender on pressure. His voice has much improved, but cough is still "brassy," and paralysis of the right vocal cord still persists; some difficulty in swallowing solids continues, but pain has disappeared. Patient was discharged from hospital at his own request on April 7th, and on May 1st was recommended for light work. He now walks about one and a half miles to and from his work daily, without dyspnoea, and can follow his occupation of cleaning tools at the bench without pain or inconvenience of any sort, except slight fatigue of the right arm and shoulder.

The following statistics, taken from records available at the Medical Graduates' College, London, may be of interest. Mr. Bennett May, F.R.C.S., in the *Lancet* of June 14th, 1894, reported the results of 35 cases of distal ligature of carotids and subclavian for innominate aneurysm. Of these, in 29 both arteries were ligatured simultaneously and figured consecutively—23 died, death being hastened by the operation; in six the disease was not checked and six were practically cured. He also reported 29 cases in which the common carotid alone was tied, and of these 19 died from operation or soon after; in six the disease was not arrested and four were practically cured, or showed marked improvement. I have also been able to find accounts of ten other cases of distal ligature of both arteries reported in the medical journals; in five the sac became firmer and smaller, and patients were able to do light work; in four death occurred in periods varying ten days to one year (two from lung trouble and one as the result of hemiplegia); in one the condition was relieved but not cured; in no case, however, was there complete consolidation of the sac, although in one it was reported to have shrunk to the size of a walnut.

A CASE OF MALIGNANT DISEASE OF THE THORACIC WALL WITH SECONDARY PLEURISY.

BY CAPTAIN KEPPEL H. REED.

Royal Army Medical Corps.

THE patient, Private H., was admitted into the Station Hospital, Jhansi, on January 10th, 1904. He complained of having a painful "lump" in the left side, which he had first noticed about six months

previously. It was then about the size of a pea, but had been steadily increasing in size up to the date of admission to hospital. There was no history of injury of any kind.

On examination, the patient was a large well-developed man, his general health was unimpaired, his appetite good and he had not lost weight. There was a smooth, hard, rather elastic tumour lying over the eighth, ninth, and tenth ribs of the left side in the anterior axillary line; it was sessile, about five inches across in its long axis, three inches broad, and projected about one and a half inches from the surface of the chest; not adherent to the skin but firmly attached to the deeper structures. On percussion, the tumour was dull, the dull area extending beyond it about one and a half inches in all directions. The heart was somewhat displaced, pulsation being visible three-quarters of an inch to the right of sternum; the apex beat was not palpable. On respiration, the left side of the chest lagged somewhat behind the right. No other abnormalities were present. It was decided, after consultation, to perform an exploratory operation, with a view to the removal of the tumour, if found practicable. On January 14th, under chloroform, an incision four inches long was made in the long axis of tumour, *i.e.*, parallel to the eighth rib, the surface of the tumour was cleared and found to be covered with dense fibrous tissue; its removal was found to be impossible, as was expected, the physical signs indicating that a large portion of it was intra-thoracic. It was then carefully incised to the depth of an inch, its cut surface being white and somewhat fibrous, and fluctuation detected. A pair of dissecting forceps were pushed gently through the intervening tissue and a cavity opened up from which sharp hæmorrhage took place, followed by the escape of a small quantity of grumous material, resembling broken-down blood clot. On rapidly inserting the finger into the cavity, which was about three inches deep, its walls were found to consist of a shreddy friable material, which readily broke down under the touch. The cavity was plugged with iodoform gauze and the incision closed on either side. The patient was put back to bed and stimulants administered, as he was rather collapsed from loss of blood. The following day the plug was changed, slight bleeding taking place, and the cavity gently irrigated. The temperature rose to 103° F. the same evening, but fell to normal the following morning. The wound was dressed daily and the patient progressed fairly well until the morning of the 26th, when he had a rigor, his temperature went up to 105° F., and he complained of severe pain in the left side and difficulty in breathing. Friction sounds were present, on auscultation, over the lower part of the chest; effusion occurred rapidly until, on February 1st, it had reached the third rib. The general condition was critical, the temperature remaining high with slight morning remissions, dyspnœa also was marked; he was accordingly aspirated in the seventh space behind, and eighteen ounces of blood-stained serum drawn off; owing to collapse symptoms supervening, the operation had to

be discontinued. On February 3rd, thirty ounces of fluid were withdrawn. His condition became rapidly worse, the left lung expanded very slightly, and he developed very severe bronchitis and dry pleurisy in the right lung. Fluid was drawn off on the 7th and 14th, the operation having in each case to be cut short. He died suddenly from exhaustion on February 17th. The following notes were made at the *post-mortem* examination:—

On removing the sternum the left pleura contained about a pint of somewhat turbulent fluid. *Left lung* collapsed, with patches of consolidation. The *right lung* showed signs of severe bronchitis; there were a few recent adhesions on the anterior surface of pleura, and the anterior border of lung was emphysematous. The heart was normal, but displaced to the right. All the other organs were normal. In the lower part of the left pleural cavity a hard lump was seen projecting from the diaphragm and lower thoracic wall, having at its apex a small ragged-edged opening. The tumour also projected into the abdominal cavity, and externally between the ribs. It was about the size of a cocoanut. It was removed by cutting through the ribs and diaphragm. On section, it consisted of a number of soft whitish nodules, varying in size from that of a walnut to a pea, each surrounded by a fairly well-defined stroma of fibrous tissue. There were several hæmorrhages in its substance, and in the centre the growth had entirely broken down; the large cavity thus formed had been opened up by the operation. The central cavity also communicated with the pleura by the ragged opening mentioned above, causing the severe pleurisy which terminated the case. A portion of the growth was sent to the Institute at Kasauli, and reported to be a sarcoma of the "large round-celled" variety. It was extremely difficult to determine whether the growth originated from the diaphragm or the periosteum of the ribs, as both were extensively involved. I think the evidence was in favour of the latter, as the periosteal forms of sarcoma are often of this variety. That the large-celled sarcoma is not so malignant as some other forms may explain the few symptoms which the man complained of, and the fact that no secondary deposits were found.

Travel.

MOTOR CYCLES IN INDIA.

BY CAPTAIN F. A. H. CLARKE.

Royal Army Medical Corps.

THE motor cycle is so pre-eminently suited for use in India, and especially to the needs of officers of the Corps, that the following notes have been written in the hope that they may induce some of those coming out during the trooping season to bring motors with them, instead of adopting the unsatisfactory method of purchasing in India, from a limited stock, of uncertain age, at greatly enhanced prices.

It must be remembered that the conditions are somewhat different from those which exist at home. One's work, generally speaking, covers a larger area, and the temperature often precludes ordinary cycling, or, at least, makes it anything but pleasurable. The motor cycle, requiring no exertion, takes one easily, and—a great advantage in the hot weather—speedily to one's destination.

Speed, everywhere but in Bombay and Calcutta, is limited only by the wishes of the rider (having due regard to the rights of other road users), and by the capabilities of the machine. The police trap is unknown, and not required. The roads are good, flat, and there is ample room for all. Motor cyclists are not so numerous as at home, and, in up-country stations at least, consist principally of the official class.

It is believed that many are deterred from becoming owners of motor cycles by reason of the complexity of the mechanism. This complexity is more apparent than real, and the management of the machine and keeping it in running order will not present any difficulty to the novice, provided that at the outset he obtains the right type of machine for his needs, and that he will take a very little trouble to grasp its essential principles. This done, the machine may be relied upon to run day after day with unfailing regularity, requiring little more attention than the average Indian servant will gladly bestow on it for an extra rupee or two per month.

General Principles.—The source of power in the engine is the explosion in a small chamber, after compression, of a mixture of petrol vapour and air. "Petrol" is the name given to a distilled spirit of petroleum, and is now generally used to describe any motor

spirit, although originally invented by one firm. When petrol is vapourised and blended in certain proportions with air, by means of a simple apparatus known as a carburettor, it forms an explosive mixture.

A glance at the diagrams will show how the power is produced and exerted. Fig. 1 shows the cylinder of an engine (*a*); with piston (*b*); connected by connecting-rod (*c*); to flywheel (*d*); contained in crank-chamber (*e*). At (*f*) is the sparking plug, between the points of which flies the small spark which fires the

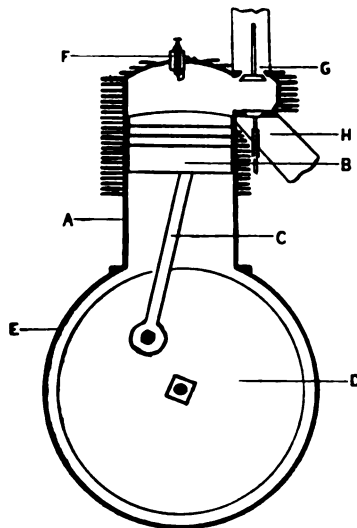


FIG. 1.

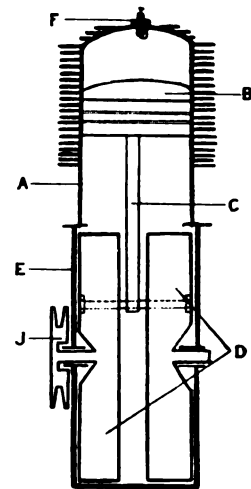


FIG. 2.

charge. The inlet (*g*), guarded by a valve, admits the mixture of petrol, vapour and air to the cylinder. Through the exhaust (*h*), which is also guarded by a valve, the products of combustion are expelled into the atmosphere. The flywheel is connected to a pulley—see fig. 2 (*j*)—outside the crank chamber. This pulley, by means of a belt or chain, conveys any rotary motion of the flywheels to the driving pulley fixed on the rear wheel of the motor cycle, and, conversely, any rotation of the rear or driving wheel will cause the flywheels to rotate and move the piston.

Suppose the motor cycle be pushed off, as in mounting an ordinary bicycle. The piston descends, sucking in the mixed petrol vapour and air (mixture) through the open inlet valve, to fill the

vacuum which would otherwise exist. The flywheel has made half a revolution, the inlet valve has shut, and the cylinder is full of mixture. If this were fired now the explosion would be comparatively feeble; so, in order to render it more effective, and enable useful work to be done by it, the next half revolution of the flywheel raises the piston, and, both inlet and exhaust valves being shut, the mixture is compressed into a small space at the top of the cylinder. At this moment a spark occurs at the points of the plug (*f*), the resultant explosion driving the piston down with great force, rotating the flywheel, the pulley attached to it, and the driving wheel of the machine. By the impetus gained the piston is pushed up to the top of the cylinder again, expelling the products of the exploded gases through the now open exhaust valve. Then the exhaust valve shuts, the inlet opens, and the same cycle of operations is repeated. The rhythmical opening and shutting of the valves, as well as the production of the spark at the correct time, is arranged by connections with the axle of the flywheel.

Ignition.—The “ignition” of a motor is the method by which the electric spark at the plug is produced. Thus “magneto” or “accumulator” ignition is spoken of. Dry batteries are so little used, except as a reserve, that it is not necessary to consider them.

The accumulator method is that in which current, produced by a suitable generator (dynamo or primary batteries), causes chemical changes in an apparatus known as an accumulator, enabling it to give off a current of electricity for a considerable time, after which it may be re-charged. This current is passed through a coil to raise its intensity, and thence to the sparking plug. A contact-breaker is introduced into the low-tension circuit (accumulator and primary of coil). Magneto ignition is similar in principle to the well-known electro-magnetic machine used in medicine, but the current produced is passed through a coil, separate in the case of the Eisemann magneto, and incorporated with the armature in the case of the Simms-Bosch. These are the most widely known forms of magneto, are known as “high tension,” and appear to be equally reliable. As regards the choice between magneto and accumulator ignition, opinion at the present time is growing daily in favour of the magneto. It costs about £5 more in the first instance, but this extra expenditure is more than compensated by freedom from troubles. Its costs practically nothing for up-keep. With accumulators there is always the risk of shortage of current, deterioration, and they require re-charging.

This last point is a consideration to anyone serving abroad, where electric installations are few and far between. Should, however, accumulators be decided on, there are many good patterns on the market. A duplicate should always be carried on the machine as a reserve. If a magneto be chosen, it should, if possible, be gear-driven, as chains are apt to stretch and upset the timing, besides being liable to break.

The Engine.—The usual limits of power in a motor cycle engine are from 2 horse-power (2 h.-p.) in a single cylinder engine, to $5\frac{1}{2}$ horse-power in a twin-cylinder. The term "horse-power" is an arbitrary one, meaning a definite unit of work, and bearing no relation whatever to the possible power of a horse. For all practical purposes 3 horse-power will be found ample. A lower is not recommended, since it is always well to have a little in reserve, and, also, lower powers are not so easy to dispose of, should it be desired to change a machine for another type. The cylinder should be air-cooled, that is, by means of the air coming in contact with the fin-like radiators on the cylinder. Cylinders can be had with a water-jacket, but these should be avoided on a motor cycle, as being a needless complication. High-powered motors (4 or $5\frac{1}{2}$ h.-p.) are usually twin-cylindere, and are not to be recommended to the beginner. They make, possibly, a rate of speed which will, probably, rarely be used, and are said to be freer from vibration, which in any case is not marked, and can be more easily and satisfactorily eliminated by the use of spring forks, and a spring seat-pillar. But their initial cost, and that of their upkeep, is proportionately greater, and they need more looking after. The valves should be mechanically operated, that is, opened by cams actuated by the engine. Some inlet valves are automatic, or operated by suction of the piston. These are apt to stick, and are said not to act as well at low speeds, owing to the suction not being strong enough to overcome the action of the spring which shuts the valve. In consequence, insufficient gas is drawn in to keep the engine firing regularly. The intending purchaser should see what facilities exist for the removal of the cylinder, in order to inspect or clean its interior. It should be possible to do this without taking the engine bodily out of the frame. A machine in which the cylinder is not reasonably accessible should be avoided, as likely later to be provocative of ill-feeling towards its designer.

The Carburettor.—This is the apparatus in which the petrol is vapourised and mixed with air to form the explosive mixture. It may be either surface or spray. The former is practically out of

date, only one well-known maker fitting it, and then only as an alternative pattern. The spray should always be chosen. In this a pipe conveys petrol from the tank to a metal receptacle, only a small amount being allowed to enter, this being regulated by a needle valve, actuated by a float which works much on the same principle as the ball-cock in a cistern. From this receptacle the petrol can be sucked out through a fine nozzle, in the form of spray, into an adjoining chamber, which has also openings in its side to admit air. The sprayed petrol instantly vapourises, mixes intimately with the air, and is drawn into the engine through the induction pipe. This is about an inch in diameter, and communicates with the interior of the cylinder through the inlet valve. A throttle should always be interposed between the carburettor and the engine, to control the supply of mixture, and there should be an auxiliary air supply in addition to the one mentioned.

Transmission.—Power may be transmitted from the engine to the driving wheel by means of a chain or belt. The vast majority of machines have belt transmission, which is probably the better of the two. The belt may be of leather in various forms, or of rubber with an inner belt of canvas. This canvas-rubber belt is recommended. There are several good makes on the market. It is clean, durable, gives no trouble, and requires no attention.

Frame and Wheels.—Modern machines have a low frame, in which the engine is set low down, so as to keep the centre of gravity as low as possible. The wheel-base, measured between the axles, is long, often measuring as much as 54 inches. This long wheel-base is said to give added steadiness to the machine. The front forks should be duplex. The single fork, as fitted in an ordinary bicycle, is, in a motor, liable to fracture by reason of crystallisation being set up in the steel. A spring fork is a desirable fitting and adds materially to comfort. The wheels should be 26 inches in diameter. Some machines have 24-inch wheels. These are to be avoided, as it is almost impossible to obtain spare covers and inner tubes for them without specially ordering them. They also are said to increase vibration.

Tyres.—Should be 26 by $2\frac{1}{4}$ inches for a 3 or $3\frac{1}{2}$ horse-power machine. Tyres of larger section are not necessary, and predispose to side-slip. Smaller ones are not suitable for the weight and strain they are called upon to bear, and are not so comfortable in use.

Brakes.—Two efficient brakes should be fitted, one on each wheel.

Weight of the Machine.—To be satisfactory, the motor must

combine the handiness of an ordinary bicycle with its own special qualities. Extra weight is unavoidable, but should not be excessive. About 150 lbs. or 160 lbs. represents an average for a 3 horse-power machine.

ACCESSORIES.

Lamp.—A good lamp is essential. Oil will do for station work, but in the long run it is more satisfactory to get a good acetylene lamp, and keep it always charged on the machine. It must be strong, and capable of casting a powerful light straight ahead, with as few diverging rays as possible. A rubber gas-bag should be incorporated in it, to ensure regularity of pressure, and consequently of light, on rough roads. The container should have no copper about it, several mysterious explosions having of late occurred in acetylene lamps, being attributed to the formation of an explosive compound by the action of the gas on the metal.

Horn.—A horn with a loud note of pleasant quality is necessary. A motor cycle overtakes other traffic with surprising rapidity, and due warning must be given.

Pump.—Must be powerful and yet portable. Should have a foot-piece which will fold up. Can be carried in two clips attached to the top tube of the machine.

Stand and Carrier.—There are several good patterns of each available. Fit the stand on the chain stays, in order not to interfere with the easy removal of the wheel if necessary for any purpose. The stand and carrier should not be combined, as it is a nuisance to have to unpack if the stand be wanted on the road.

Spare Parts.—Certain "spares" should invariably be brought abroad. They may never be required, but they do not cost much, and may possibly save much tedious waiting for a trivial part.

The following are recommended :—

Two sparking plugs, one set of piston rings, one exhaust valve complete with springs, one inlet valve complete with springs, one belt, one carburettor float, one pair platinum contacts for contact breaker, one inner tube for tyre, one yard insulated wire (low tension flexible). It is also advisable to get a pair of smoked glass goggles for use during the hot weather, to protect the eyes from dust and glare.

Cost of Running.—This necessarily varies with the amount the machine is used, and also with the locality. Thus in Bombay the cost of petrol is 1 rupee (1s. 4d.) per gallon. In Meerut, 929 miles distant, it is 1 rupee 12 annas, equivalent to 2s. 4d. in English

coinage. One gallon is sufficient for from 100 to 120 miles, running with a 3 horse-power engine of good construction. It is supposed to be enough for 150 miles, and probably would be if the running were continuous, but losses from evaporation, &c., bring the mileage down to what is given above. Lubricating oil, which must be of the best quality, costs the high rate of $6\frac{1}{2}$ rupees (8s. 8d.) per gallon. Two fluid ounces go into the crank chamber every 15 or 20 miles. With magneto ignition, the above are the only running costs, and work out approximately 12s. 6d. per month of thirty days, doing on an average 15 miles daily. Small incidental expenses must be expected, but with a good machine they should be very trifling. The expenses from reasonable wear and tear are practically confined to the belt and tyres, and, if these are originally of good quality, are not heavy.

Passenger Attachments.—Although the motor cycle is essentially a machine for one person, attachments can be made, if desired, by means of which a passenger may be taken with a fair degree of comfort at a good average rate of speed. The 3 horse-power motor will do, but to be certain of sufficient power under adverse circumstances, such as a strong head wind and a heavy passenger in a side-carriage, a higher horse-power is desirable. The passenger attachments available are the trailer, side-carriage and fore-carriage. The fore-carriage may be dismissed as unsuitable for India. Situated in front of the engine it effectively screens it from the rush of air so necessary to cool the heated cylinder, and the power rapidly falls from destruction of the lubrication. The trailer is not, in this country, the dangerous conveyance it is in England, owing to the different conditions. It is easily attached, inexpensive, and useful, but has the marked disadvantage that its occupant gets a good deal of dust when there is any on the road, and that ordinary conversation is impossible. The side-carriage, in its best form with compensating joints, is probably better. It has the advantage of greater sociability, the rider and passenger being side by side, and it is said to be safer. Against it is urged that it is hard on the tyres, that if not fitted with compensating joints it exerts a twisting strain on the frame of the cycle, and that it is not easy to drive when there is no passenger. If a side-car is being bought the advisability of having a free-engine clutch fitted to the engine, by means of which it can be started like a car, should be considered. It is almost essential. Also the tyre, should, if possible, be of the same dimensions as those on the motor cycle, and should fit the rim. This reduces the number of "spares" necessary, as the tyres are interchangeable.

In conclusion, it is desired to mention that detail, beyond the most superficial, has been intentionally omitted from these notes as being beyond their scope. Those who wish to investigate further will find simple and up-to-date information in the handbooks published by the papers devoted to motors and motor-cycling. It is only desired to draw attention to a pleasant, inexpensive and rapid form of transport, which is daily growing in popularity and usefulness. The motor car, train, omnibus, boat, ambulance, and even motor gun, are with us, and the motor-cycle engine is a simple type of them all.

THE GHURKHA "KHUD" RACE.

By LIEUTENANT-COLONELS J. R. DODD AND H. L. BATTERSBY.

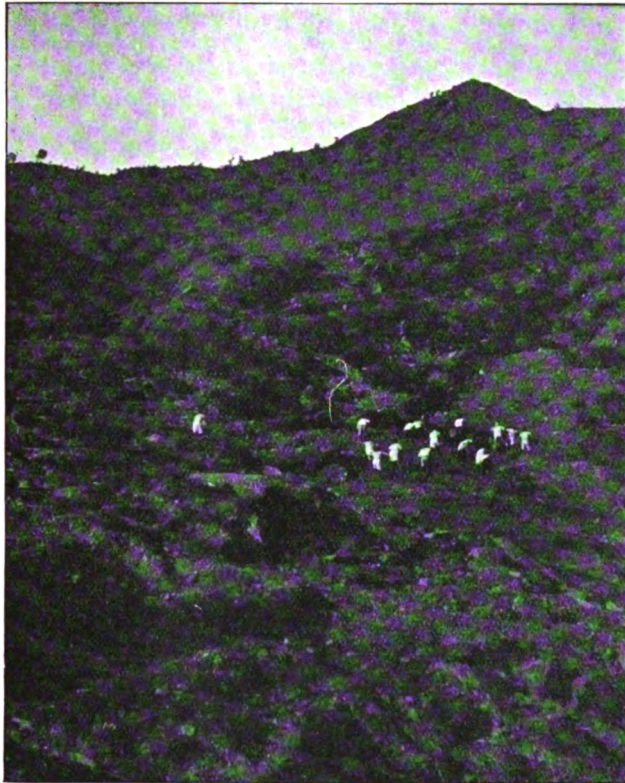
Royal Army Medical Corps.

MOST of the readers of the Journal are probably acquainted with the Ghurkha regiments of the Indian Army, composed of the hardy mountaineers of the neighbouring Principality of Nepal, and who are by many considered to be the cream of the native Army; but few are probably aware that these regiments compete among themselves every year for a trophy, which constitutes the blue ribbon of the Ghurkha branch of the Army, and the possession of which is as eagerly coveted and worked for as any other trophy in the whole Army.

The prize is a silver statuette of a Ghurkha in Nepalese costume, as a perpetual challenge cup, and the possession of it is proudly pointed to by every one in the successful regiment as evidence of the mountaineering skill and endurance of the winner. The competition is called the "'khud' (or mountain climbing) race." It was held early this year near Ranikhet, and perhaps some account of it may prove interesting to readers of the Journal.

The competition was instituted by the 5th Ghurkhas in 1894, they presenting the trophy for competition year by year, in perpetuity, to adorn the mess table of the successful regiment during the year of possession. The race is open to three competitors from any Ghurkha battalion; the 5th Battalion generally select the date, and sometimes the course itself, but as regards locality there is no fixed rule. It is generally understood that the battalion winning the trophy should suggest the station for the next competition. The selection of the course materially affects the result

of the contest, as one which would suit one set of competitors might be quite the reverse to others, some men being better going up hill and some coming down, greatly depending on the place of training. It is always chosen in the Himalayas, and consists, generally, of a run up to a point on the top of one of the hills, varying from 1,000 to 2,000 feet above the level of the starting point, the angle of ascent varying according to the ground chosen. This year's



The road to the point.

course being very little short of the perpendicular, the rate of progress, during the ascent, was correspondingly comparatively slow; the course then ran for some distance along the top of a ridge, and then down to the winning post. The rate at which these Ghurkha Riflemen come down the hill is perfectly marvellous; even at a distance they can be seen to be moving at a good pace,

and they appear to negotiate steep banks of anything from ten to thirty feet by the simple process of apparently hurling themselves down. This year was the twelfth contest, and the winners were as follows: First year, the 1st Battalion 5th Ghurkhas; the next four years the trophy was held by the 1st Battalion 3rd Ghurkhas; the next year (the significant 1899) there was no race. During the next two years the race was won by the 1st Battalion 3rd Ghurkhas, after which the 1st Battalion 5th Ghurkhas held it for three years; it was then again borne off by the 1st Battalion 3rd Ghurkhas, who held it until this year, when the 1st Battalion 5th Ghurkhas won the trophy, which, after having remained in the mess of the 1st Battalion 3rd Ghurkhas for seven years passed into the hands of another battalion, after a gallant struggle on the part of the contestants. The course was three miles: one mile of ascent, one mile along the top of the ridge, and one mile descent; the descent was particularly stiff, necessitating a good deal of scrambling over boulders and very rough ground, where a slip or fall would result in a considerable roll downhill, and possibly a serious injury. The time taken was twenty-four minutes. The selection of candidates differs in various battalions; the 1st/3rd are selected by an annual competition, by companies: twelve men from each run over a stiff course—a challenge shield is held by the company whose team of twelve does it in the shortest aggregate time. The men eventually chosen for the big race are put into training two or three months before the probable date. They wear no boots or shoes, so as to harden the feet (the race is run barefoot), are given a strict diet, which includes meat, and regular exercise. Sometimes the work is overdone, as happened this year, which, according to the officers of the 1st/3rd Regiment, is the cause of their defeat.

It has been suggested that the strain of this hill climbing is so great that there is a danger of injuring the heart. The competitors have frequently been examined by a medical officer, both before and after a severe practice run, and the most careful examinations have failed to disclose any symptoms which would support this supposition, and the condition of the competitors at the finish showed nothing more than a little temporary embarrassment of respiration. In a wonderfully short time they all paraded for their prizes as cool as if, but for a few scratches, they had been merely looking on.

Reviews.

THE OPERATIVE TREATMENT OF PROLAPSE AND RETROVERSION OF THE UTERUS. By J. Inglis Parsons, M.D., M.R.C.P., M.R.C.S. London: John Bale, Sons, and Danielsson, Ltd., 83-91, Great Titchfield Street, Oxford Street, W. 3s. 6d. net.

In this booklet of ninety pages the author presents to the profession the details of an operation he has invented for prolapse of the uterus. Readers of the *British Medical Journal* are already aware of the excellent results obtained by Dr. Inglis Parsons by means of the injection of sulphate of quinine into the folds of the broad ligament, and they no doubt, as well as others, will be gratified to have the whole technique of the operation most minutely and carefully described. In the hands of the author the operation has been attended with the most unqualified success, and he rightly argues that this very simple procedure should in nearly every case replace the more formidable operation of hysteropexy. The great features claimed for the operation are that it does not interfere with a subsequent pregnancy as does hysteropexy, unless the sutures are planted well forward, that no pain follows the operation, and that it can be performed with perfect safety even in old age, as the shock of the operation is practically *nil*. The records of 105 cases so treated which are introduced should convince the most sceptical.

In addition, there is a most interesting chapter on retroversion and retroflexion, and another on the various operations already in vogue for the suspension of the uterus, ending with a comparison of their relative values.

The printing is good, and the illustrations are not the least valuable feature in this useful little volume.

A. E. C. K.

THE SHIP SURGEON'S HANDBOOK. By A. Vavasour Elder, M.R.C.S., L.R.C.P. Pp. 167, cr. 8vo. Baillière, Tindall and Cox. 3s. 6d. net.

A thoroughly practical little manual, which may be strongly recommended to any practitioner contemplating a period of service in the mercantile marine. It deals thoroughly with such questions as the selection of a steamship line in which to apply for service, such things as are advisable in addition to the Board of Trade scale, instruments and appliances, stations and duties on board, sea-sickness, passengers convalescent from previous illness or voyaging for reasons of health. The vexed question of fees from passengers for services rendered is dealt with, but not, in our opinion, with sufficient emphasis in a guide to the uninitiated. At present, owners do not allow these to be charged, and thus when they do pass, they assume practically the form of tips, such as are given to the stewards, and are hence derogatory to the profession. The position undoubtedly ought to be, that in return for his monthly pay the ship's surgeon's duty should be to treat, without further remuneration, the ship's officers and crew and steerage passengers; but taking into consideration the small amount of his pay, and the extent to which it is

taxed for the purchase of uniform, outfit, instruments and supplementary drugs, and the fact that, for various reasons, his period of employment is only brief and temporary, he must be regarded as underpaid, and therefore, as his just due, should be allowed to charge first and second class passengers such fees as they would pay on shore for corresponding services. The present position is the result of that mercantile instinct which leads a business community to exploit the medical profession to the utmost possible degree, and which it is the duty of the profession to combat most strenuously. Another point which is not sufficiently insisted on is that the man who takes up a billet as a ship's surgeon with the view of seeing the world sees very little of it but the open sea and the ship's ultimate destination. In these days of steam, ships spend but a very few hours in intermediate ports of call.

The appendices contain most useful and necessary lists of uniform, outfit, drugs, instruments, medical stores, emergency appliances, steamship lines with rates of pay, copies of various necessary certificates, such clauses of the Merchant Shipping Act as are important, and the like. Altogether a good, sound and practical book.

E. A. S.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE (Memoir XVIII.). Reports of the Expedition to the Congo, 1903-5. Published for the Committee of the Liverpool School of Tropical Medicine, by Williams and Norgate, 14, Henrietta Street, London. Price 7s. 6d. net.

This volume contains two papers on Human Trypanosomiasis, or Sleeping Sickness, by the late J. Everett Dutton and J. L. Todd, two papers on Parasitic Acarids, by Robert Newstead and J. L. Todd, and one on the Anatomy of the Proboscis of Biting Flies, by J. W. W. Stevens and R. Newstead.

The first paper, entitled "Gland Palpation in Human Trypanosomiasis," is based on the work of Greig and Gray in Uganda. The object of this paper is—(1) to prove the superiority of gland puncture over other methods of detecting the presence of trypanosomes (in negroes), and to determine with what constancy the parasites might be found in the glands of persons known to be infected with trypanosomes, and (2) to decide what reliance should be placed upon the presence of glandular enlargement (in negroes), without any obvious cause, as a diagnostic sign of trypanosomiasis.

Three tables are given which, in the opinion of the authors, indisputably indicate that gland puncture is by far the most efficient method of demonstrating the presence of trypanosomes in cases of trypanosomiasis. In early cases of sleeping sickness the trypanosomes were found in the glands in 98.5 per cent., and in advanced cases in 95.6 per cent. The post-cervical glands give the best results, and are easiest to manipulate.

In regard to the second question, experience led them to believe that, in the great majority of cases, "enlarged cervical glands in apparently healthy negroes mean trypanosomiasis." It is therefore suggested that in heavily infected districts all persons with generally enlarged glands must be suspected, without exception, of suffering from sleeping sickness. On the other hand, the result of the examination of natives in non-sleeping sickness areas showed that, as a rule, enlarged cervical glands, without obvious cause, do not occur.

From these facts the authors are led to advise certain preventive measures, which they think may help to stem the steady and alarming progress of sleeping sickness. This is to be done by limiting the peregrinations of the apparently healthy, but none the less infected, persons who, at present, scatter the disease uninterruptedly about Africa, by the establishment of posts of inspection along the main routes leading to uninfected districts, and the removal of infected persons from posts in uninfected districts to places already infected.

In regard to treatment the authors advise the constant and thorough exhibition of atoxyl.

The second paper treats of the Distribution and Spread of Sleeping Sickness in the Congo Free State, and proposes measures designed to prevent the extension of the disease to districts as yet uninfected. It is interesting as giving for the first time an account of the distribution of the disease on the Congo, its lines of spread, and the numbers involved. Three maps show the supposed distribution of sleeping sickness in 1884, 1897, and 1905. From these it can be seen that the disease has increased very much of late years, and has extended as far inland as the shores of Lake Tanganyika. As in Uganda, it was found that peoples living along the banks of large bodies of water have suffered the most heavily, also that *Glossina palpalis* was found practically everywhere along the route. In regard to the severity of the epidemic in Congo territory the authors state that "populous districts have become almost deserted within a few years, and that a large proportion of the deaths were certainly due to sleeping sickness." The figures usually given for the number of deaths from trypanosomiasis in Uganda and the Congo are so colossal that they shrink from repeating them. Because of the following observation they, nevertheless, believe that they approximate the truth. It was found that from 30 per cent. to 50 per cent. of the population was infected in many of the villages along the route followed. It is generally accepted that only a very small percentage of persons infected with trypanosomes can be expected to "recover." Therefore at least *a third of the people inhabiting these districts will probably die of trypanosomiasis.*

It seems advisable that the utmost should be done to protect uninfected districts from a like fate.

The authors' conclusions are:—

(1) The enormous spread and great increase of sleeping sickness in the Congo basin during recent years has been due, in a great measure, to the increase in travel following the opening of the country.

(2) Cases of trypanosomiasis, though apparently healthy, may be detected by their enlarged glands.

(3) Good results may be expected from the serious application of quarantine measures dependent for their efficiency upon cervical gland palpation.

ON MEANS FOR THE PROLONGATION OF LIFE. Second Edition. By Sir Hermann Weber, M.D., F.R.C.P. London: John Bale, Sons, and Danielsson, Ltd., 83-91, Great Titchfield Street, W. Price 2s. 6d.

This is a treatise of ninety-three pages, giving advice as to the means available to man for warding off disease and early deterioration of the

organs. The author puts 100 years as the age to which the human species should aspire. There is no royal road to this prolongation of health and life described in this book. The strait and narrow path of temperance, exercise, fresh air, and hard work must be walked by the aspirant. It is useful, especially to young men, to read such books as this from time to time. They may not follow the advice as a whole, but at least they learn to know the opinions of those who have "passed through the mill" of life.

In regard to alcohol, the author says that many persons consider themselves moderate if they never become drunk; some take five or six glasses of sherry or port in the twenty-four hours, or two or three pints of beer, or three or four glasses of brandy or whisky, and consider themselves moderate. He thinks it a very dangerous kind of moderation to the majority of people. The slow and insidious manner in which the regular drinking of so-called moderate, but in reality immoderate, quantities acts is one of the causes of the frequency and danger of this error. *The fourth part of the quantity mentioned above is what he calls moderation permissible to the majority of persons.*

Current Literature.

Transport of Severely Wounded Men.—Dr. Lawner, Regimental Surgeon, describes, in *Der Militärarzt*, No. 5 of 1906, an apparatus for the transport of severely wounded men, in the lying-down position, on country carts.

It is intended for two men, placed side by side, and consists of two ash planks, the head and foot bars, 5 feet 9 inches in length, 2½ inches in breadth, and 1½ inches in thickness; a piece of hemp cord is fixed to each end of the planks, where there is a hole, and on the under side a ring for drawing the cord through. These cords serve to lash the planks across to the side beams of the "Leiter-wagen," or "ladder-waggon," a common waggon on the Continent. The body of the litter, or stretcher, consists of two pieces of canvas, about 6½ feet long, provided with loops at both ends, through which the planks are passed. To the outer edges of the canvas are attached three short cords for tying to the side beams of the waggon; the inner edges are strengthened by binding and a sewn-in cord. The head part of the canvas is double, forming a pocket opening behind, which can be filled with straw, &c., to form a pillow.

Two covers of tent cloth are provided, which serve as a waterproof protection when the litter is rolled up and as a protection for the patients when in use.

The litter can be used with any waggon with side beams, capable of holding two men side by side in the recumbent position at the level of the beams. For use it is placed transversely on the waggon, the ends of the

planks resting on the sides to which they and the outer edges of the canvas are lashed.

The weight of the litter is about 30 lbs., and Dr. Lawner calculates that about forty of them can be carried in one waggon. In comparison two field stretchers weigh about 51 lbs., and the methods hitherto used for carrying stretchers slung on waggons, for severely wounded cases, have proved unsatisfactory.

By allotting two waggons per Division, one per Field Hospital, &c., Dr. Lawner reckons that an Army Corps would be provided with 880 of these litters for badly wounded men, without unduly augmenting its amount of transport. The cost of the litter is put at 30 kronen (25s).

G. COURTS, *Lieutenant-Colonel, R.A.M.C.*

Neutral Red and the Rapid Diagnosis of the Pollution of Drinking Water by the Bacillus Coli.—In the *Bulletin de l'Institut Pasteur* for July 15th, 1906, Surgeon-Major A. Braun, of the Val-de-Grâce, demonstrates an easy method of research for the detection of the *B. coli communis* in samples of drinking water. After quoting Vincent, Petruschky, Pusch, Savage, Rothberger, Heller, Scheffler, Kohler, Wolff, and Oldekop, and his own efforts in this direction, he recognises that the several media which contain neutral red are absolutely perfect for the differential diagnosis between the bacillus of typhoid fever and the *B. coli communis*, and he now describes a medium which permits us to make use of the fluorescent reaction to at once detect the coli-bacillus in drinking water.

After many trials, he prefers the formula given by W. G. Savage for the preparation of the nutrient medium.

Savage's Bouillon.—Boil 125 gr. of lean beef in half a litre of water. When cold add

Peptone Defresne	...	...	...	...	10 gr.
Salt	...	...	...	...	10 „
Glucose	...	...	...	...	2 gr. 50.

Make up to 500 cc. with water and boil again. When cold decant, and then add 5 ccm. of the following solution :—

Neutral red	...	...	...	...	5 gr.
Water	...	...	...	...	100 ccm.

The bouillon is then heated in the autoclave at 115° C. for thirty minutes ; it has now a ruby-red colour.

How to Detect the Bacillus Coli in Water.—Two tubes, each containing 6 ccm. of bouillon, as above, are diluted with respectively 1 cc. and 10 ccm. of the water for analysis. These are placed in the incubator for twenty-four hours. If the added water contains any *B. coli*, gaseous bubbles are formed in the upper part of the bouillon, which becomes fluorescent or canary-yellow, according to the quantity of bacilli present. If the alteration in colour has not taken place after being forty-eight hours in the incubator, one can be certain that the water contains no *B. coli* to any appreciable extent. Dr. Braun's experience is as follows :—

(1) *The Reaction is Constant.*—In each case in which the reaction took place, the presence of the *B. coli* was confirmed by the usual tests (gelatin-glucose, carbolie acid bouillon, litmus-milk-whey, milk, indol, inoculation of guinea-pigs).

(2) *The Reaction is Rapid.*—The fluorescent tint, or the canary-yellow colour, must be obtained within forty-eight hours, at the latest, after treatment in the incubator. As a rule, the reaction is marked after twenty-four hours.

(3) *The Reaction is Specific.*—Experiments were made on the most varied assortment of germs (cocci of all sorts, *B. diphtheriæ*, all strains of *B. dysenteriæ*, *B. pyocyaneus*, Friedländer's pneumobacillus, various strains of Eberth's bacillus and of *B. paratyphosus*, and of cholera vibrios, &c., &c.), but the fluorescent discolouration, or canary-yellow colour, was only obtained when the bouillon was contaminated with colonies of *B. coli*.

(4) *The Reaction is a very Delicate One.*—The tip of a fine platinum wire was dipped into a bouillon culture of *B. coli*, and then into two litres of sterile water; 1 cc. of this water was then added to a tube of neutral-red-bouillon; a positive reaction was obtained in twenty-four hours, as also when the water was again diluted to 1 in 10.

(5) *The Reaction can be used as a Quantitative Estimate of B. coli.*—Whilst carrying out the last experiment, a certain number of neutral-red bouillon tubes can be dosed with variable quantities of the suspected water (one drop, five drops, ten, twenty, thirty, forty, fifty drops, &c.), and at a glance one can estimate the value of the water in terms of *B. coli*. The presence of *B. coli* in the water now enables the expert to direct his researches for Eberth's bacillus or other pathogenic germs, which are generally to be found near the surface of the water after standing for some time. The definite and very encouraging results, obtained by means of this summary analysis of five hundred samples of water, enable us to recommend this method of testing with neutral-red for the quick detection of faecal contamination of drinking water, with a view to the prophylaxis of enteric fever.

J. E. NICHOLSON, *Lieutenant-Colonel, R.A.M.C. (R.P.)*.

Treatment of Mediterranean Fever with Collargol.—F. Reich, Senekal, Orange River Colony, reports in the *Transvaal Medical Journal*, June, 1906, p. 348, two cases of Mediterranean fever treated with collargol in a series of about fifty which have come under his observation in that district:—

(1) A farmer, aged 37, four months' fever with constipation, pain in the back and right hip, epistaxis, great emaciation and debility, condition nearly hopeless. Ten cc. of a 2 per cent. solution of collargol were injected intravenously, and were repeated two days later. Symptoms improved and pyrexia ceased for a week. Ten cc. of the solution were again administered, and were followed by improvement for ten days. The dose was repeated, with amelioration for three days. He then gave, daily, intravenous injections for five days. Convalescence was rapid. The diagnosis of Malta fever was confirmed by the patient's blood serum completely clumping a reliable emulsion of the *Micrococcus melitensis* in a sixty-fold dilution fifteen months after recovery.

(2) Defervescence after two injections.

For the relief of neuralgia during and after the fever Reich has found aspirin of value in doses of 8 grains, four to six times daily.

C. BIRT, *Lieutenant-Colonel, R.A.M.C.*

Studies on *Spirillum Obermeieri* and Related Organisms. by F. G. Novy, M.D., and R. E. Knapp, B.S. (*Journal of Infectious Diseases*, vol. iii., No. 3, May, 1906, pp. 291-393, Chicago, U.S.A.). This is a very interesting paper, and marks a distinct advance in our knowledge of the Spirochætal diseases. Since the discovery by Schaudinn and Hoffman of *Spirochaeta pallida*, the accepted cause of syphilis, these diseases have naturally attracted a great deal of attention. The main results of this important study have been condensed by the authors into the following statements:—

“(1) *S. obermeieri* belongs to the bacteria, and not to the protozoa.

“(2) In onset blood, kept *in vitro*, it may be maintained alive for forty days, whereas in decline blood, owing to the presence of a germicidal agent, it rapidly dies out.

“(3) Man, monkeys, white mice, and rats, tame and wild, are subject to infection. The first three are subject to relapses, the latter are not.

“(4) All attempts at cultivation have proved unsuccessful.

“(5) A powerful germicidal body is present in decline and in recovered blood, notably in blood of hyperimmunised rats. This body does not originate after the blood is drawn, but exists within the living animal.

“(6) An immunising body is also present, and is probably distinct from the germicidal agent.

“(7) Pfeiffer's phenomenon can be demonstrated *in vitro*, and *in vivo*. In the peritoneal cavity of hyperimmunised rats the spirilla are killed almost instantly, after which they are taken up by the macrophages or large mononuclear cells.

“(8) Active immunity follows from the infection. By successive injections of spirillar blood this immunity can be increased to a remarkable degree.

“(9) Passive immunity can be imparted by injections of recovered or hyperimmunised blood.

“(10) Both active and passive immunity may last for months.

“(11) Hereditary immunity can be obtained, and is probably the result of infection *in utero*.

“(12) Preventive inoculations can be successfully made in rats, mice, and monkeys.

“(13) Infected rats, mice, and monkeys can be promptly cured by injection of hyperimmunised blood. Subsequent relapses, if any, can be prevented by curative doses of blood.

“(14) The preventive dose should be about ten immunity units per 100 grains body-weight.

“(15) The curative dose is about five immunity units per gram body-weight.

“(16) A solid basis is thus established for the prevention and cure of relapsing fever in man.

“(17) Agglutination of spirilla occurs *in vitro* and *in vivo* under the influence of recovered or hyperimmunised blood. To a slight extent it occurs during crisis.

“(18) The agglutination, germicidal and immunising properties of recovered blood can be used in the sero-diagnosis of relapsing fever, also for the identification of spirilla.

"(19) *S. obermeieri* can be made to pass through a Berkefeld filter.

"(20) The tick fever of Africa is distinct from the relapsing fever of Europe. Its cause is *S. duttoni*.

"(21) The spirillum of the relapsing fever of Bombay is apparently different from *S. obermeieri* and *S. duttoni*.

"(22) The evidence points to the existence of a group of relapsing fevers.

"(23) True spirilla occur in the stomach and intestines of insects.

"(24) The demonstration that *S. obermeieri*, *S. duttoni*, and *S. gallinarum* are bacteria and not protozoa, means that many, if not all, of the other spirochætæ belong to this same group.

"(25) The difference in number and arrangement of flagella may lead to a division into sub-genera.

"(26) The transition of spirillar diseases by insects, and the congenital infection of mammals and eggs of insects, are properties which, up to the present, have been regarded as characteristic of protozoa. These properties are now known for the first time to be shared by this group of bacteria. Yellow fever presents a marked analogy to the spirillar infections, and it is not improbable that the cause of this disease will be found to belong to this group of organisms."

Journal
of the
Royal Army Medical Corps.

Original Communications.

REPORTS OF THE COMMISSION APPOINTED BY THE
ADMIRALTY, THE WAR OFFICE, AND THE CIVIL
GOVERNMENT OF MALTA, FOR THE INVESTIGA-
TION OF MEDITERRANEAN FEVER, UNDER THE
SUPERVISION OF AN ADVISORY COMMITTEE OF
THE ROYAL SOCIETY.

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(Continued from p. 321.)

REPORT ON THE PREVALENCE OF MEDITERRANEAN FEVER
AMONGST BRITISH TROOPS IN MALTA, 1905.

BY LIEUTENANT-COLONEL A. M. DAVIES.

Royal Army Medical Corps; Member of the Mediterranean Fever Commission.

CASE 11.—Private Keylock, Hants Regiment, was admitted to Valletta Hospital with gonorrhœa on July 29th; he was discharged on September 1st, and readmitted, suffering from Mediterranean fever, on September 15th. It is almost certain that he contracted the infection during his stay in hospital.

CASE 12. — Private Collins, Hants Regiment, admitted to Cottonera, March 23rd, 1905, suffering from enteric fever, as shown by serum reaction; serum reaction was negative to Mediterranean fever, March 27th and April 29th, but positive on May 1st, when he had been in hospital thirty-eight days; infection was therefore probably contracted in hospital, though conceivably along with the enteric infection before admission.

CASE 13.—Private Bishop, Hants Regiment, admitted from Verdala to Cottonera, March 30th, with scarlet fever; was isolated in No. 12 Ward from this date until April 26th, when he was transferred to No. 5 Ward, where he remained until discharge on May 2nd; was readmitted May 10th, and diagnosis made of Mediterranean fever on May 15th. His illness came on suddenly on May 9th, and was almost certainly contracted between March 30th and May 2nd, while he was in Cottonera Hospital.

CASE 14.—Gunner Abbott, 65th Company, Royal Garrison Artillery, was admitted from Upper St. Elmo to Cottonera, May 16th, and placed under observation for mental disease. After being in hospital under close observation for thirty days symptoms of Mediterranean fever developed, and the diagnosis was made on June 21st. The length of sojourn in hospital before onset of fever symptoms points to infection contracted within the hospital precincts. It is to be noted, however, that three men in 65th Company were admitted with Mediterranean fever on May 18th, 19th and 20th (having presumably been ill a few days before, and conceivably infectious); and that other admissions from the same company for this disease took place on June 1st, 3rd, 16th, 19th and 20th; infection was therefore present in this company in Upper St. Elmo.

CASE 15.—Private Haines, Hants Regiment, was admitted from Verdala to Cottonera, No. 10 Ward, with "abscess," on April 21st; Mediterranean fever was diagnosed May 19th; there were fever cases in No. 10 Ward at the time of his admission; it is more probable that infection was taken during the twenty-nine days' sojourn in this ward than in Verdala Barracks previous to admission; in these barracks one case only had occurred in March, one in April, and none in May.

CASE 16.—Gunner Duncan, 63rd Company, Royal Garrison Artillery, was admitted from Ricasoli to Cottonera, No. 1 Ward, with gonorrhœa, on April 4th; on May 22nd Mediterranean fever was diagnosed. This was almost certainly contracted during his preceding seven weeks' sojourn in hospital. Only one case of fever occurred at Ricasoli (February 3rd) during the first four months of the year.

CASE 17.—Private Knight, Hants Regiment, was admitted from Couvre Porte to Cottonera, No. 1 Ward, on March 28th, with gonorrhœa. Mediterranean fever was diagnosed on May 23rd, seven weeks afterwards. Infection was almost certainly contracted in hospital.

CASE 18.—Private Wilkinson, Lancashire Fusiliers, was admitted from Zeitun Barracks to Cottonera, No. 1 Ward, with gonorrhœa, on March 3rd; the first symptom of fever was felt about June 3rd, and the diagnosis made on June 13th. Infection certainly contracted in hospital.

CASE 19.—Private Shortland, Hants Regiment, was under treatment in Cottonera Hospital for gonorrhœa from April 26th to June 3rd. On June 20th he fell ill, and was admitted on 21st, suffering from fever, which was diagnosed on 29th. The shortest incubation period may probably be considered to be about fourteen days; he might have contracted infection, therefore, in the three or four days immediately after his discharge from Cottonera on June 3rd, or while in hospital during the previous fortnight. Four cases were admitted from Verdala Barracks in June, one being from the same company as Shortland; there had been no admissions in May; during this month and the early part of June, when he presumably contracted infection, there were twenty or more cases of Mediterranean fever in Cottonera Hospital, which was therefore a more likely source of infection than Verdala Barracks.

CASE 20.—Gunner Taylor, 99th Company, Royal Garrison Artillery, was under observation for mental disease in Cottonera Hospital from June 2nd to 20th; he was readmitted with fever on June 29th, and Mediterranean fever was diagnosed July 7th. It is more likely that infection was contracted between June 2nd and 20th than between June 20th and 29th, or before June 2nd.

During July and August no cases of Mediterranean fever appear to have arisen among the patients at Cottonera, though four orderlies of the Royal Army Medical Corps were attacked.

CASE 21.—Private Smith, Royal West Kent Regiment, was in the hospital from June 27th to July 5th, and from July 7th to August 5th, suffering from wound of foot; during the latter period he was in No. 1 Ward. He was readmitted with gonorrhœa on August 11th. He first felt ill with fever on September 3rd, and Mediterranean fever was diagnosed on September 9th. He might have contracted the infection during his brief residence in Floriana Old Barracks between August 5th and 11th, or in hospital during the twenty-four days immediately preceding the onset of his illness, when he was in No. 1 Ward, in which were Mediterranean fever patients. Floriana Old Barracks suffered from fever earlier in the year, but no case was admitted from them between July 24th and August 28th.

CASE 22.—Private Palmer, Essex Regiment, was transferred

from Valletta to Citta Vecchia Sanatorium on December 19th, 1904, suffering from hernia; on February 2nd, 1905, his "disease" was changed to Mediterranean fever; the date of onset is not certain, but the probabilities are that infection was contracted in hospital, either at Citta Vecchia or Valletta.

CASE 23.—Gunner Haynes was admitted to Forrest Hospital from Tigne on May 12th, with enteritis, and was transferred to Citta Vecchia on August 16th; on September 1st his "disease" was changed to Mediterranean fever; the blood had reacted before leaving Forrest, and infection was, without doubt, contracted there.

Of the above 23 cases it may be affirmed that 16 almost certainly became infected in hospital; Cases 5, 6, 10, 14, 19, 20 and 21 are doubtful, but in my opinion the probabilities are much in favour of hospital infection in all the cases except No. 5 (Bush), 10 (Heaton), and 14 (Abbott), in which the uncertainties are considerable. Of the 11 Valletta cases, eight were venereal patients treated in 20 B Ward; Salmon and Wilding had been inmates of 20 A Ward; in the case of Heaton, who had been under treatment for debility, the ward is uncertain. Of the 10 Cottonera cases, four venereals and one other (Smith) had been treated in No. 1 Ward, two (Abbott and Tayler) had been in observation wards, two (Collis and Haines) in the "fever wards," and one (Bishop) in No. 5 Ward. Therefore 10 out of the 11 Valletta cases had been inmates of the same apartment (albeit a very large one) as was occupied by patients suffering from Mediterranean fever; and three out of the 10 Cottonera cases had, in the same way, been treated in the wards along with the Mediterranean fever patients.

Of the 19 cases amongst N.C.O.'s and men of the Royal Army Medical Corps at Valletta Hospital, the following were brought into intimate association with the Mediterranean fever patients, being employed in the fever wards, either as nursing or as general duty orderlies: Elsey, Brooks, Smith (14,901), Bowden, McGill, Smith (19,123), McConaghey, Whitmore, Aldous, Hardless, Playle; eleven in all. The following were not employed in these wards, and did not come into any continued or close association with the fever patients: Quartermaster-Sergeant Dudman, Brown (clerk), Farr (cook), Sergeant Dewberry (laboratory), Corporal Hughes (day wardmaster, not in fever wards), Corporal Woods (pay office), Robinson (Principal Medical Officer's clerk), Quartermaster-Sergeant Bridges; eight in all. Of these eight men it may be said that not only were they not brought into any special contact with fever

patients, but that they had absolutely nothing to do with them, either directly or indirectly (except the two Quartermaster-Sergeants). These two non-commissioned officers had certain duties in regard to the clothing and bedding of the patients that would constitute an indirect connection. Sergeant Dewberry was specially employed as assistant in the laboratory of the Mediterranean Fever Commission; there can be little doubt that it was in this occupation that he contracted the disease.

All the Corporals and Privates of the Royal Army Medical Corps sleep in the same barrack room, No. 31 (with an adjacent bunk); this is a large apartment, 96 feet long by 31 feet wide, the side annexe being 28 by $17\frac{1}{2}$ feet. The room is well lighted, and airy in appearance, but on account of its extreme width and the absence of through cross ventilation (the annexe and two sergeants' rooms adjoining it on one side), it is difficult to secure a satisfactory change and renewal of the contained air. The height is 20 feet in the main room, and 15 feet in the annexe. The accommodation is authorised as for 54, giving an average cubic space of 1,238 cubic feet per head; or, reckoning the height at 12 feet, of 770 cubic feet per head. The room has been full throughout the year, but not overcrowded in the hot weather, as many of the men sleep out on the roof or on the verandah. The three men attached to Royal Army Medical Corps for duty also slept here. Of these, two (Davis and Franklyn) were employed in the female hospital in general duty work. Cases of Mediterranean fever have been under treatment in this hospital throughout the year, but the orderlies were not brought into direct association with them in any way.

Of the seven cases occurring amongst Royal Army Medical Corps at Cottonera Hospital, five were employed in the Mediterranean fever wards; the other two, Rogers and Miller, were both employed in the hospital kitchen; part of their duties being to supervise the milking of the goats; they also took their turn of general night duty.

The two cases of Royal Army Medical Corps at Citta Vecchia had both been employed in attendance on convalescent Mediterranean fever patients, of whom there have been a large number at this hospital throughout the greater part of the year.

At Valletta Hospital four ladies of Queen Alexandra's Imperial Military Nursing Service have been employed in nursing duties. Of these, one has suffered from Mediterranean fever during the past year. At Cottonera there is also a staff of four, and during 1904 and 1905 six nursing sisters have been attacked; four cases

occurred in June and July, 1904, and two in January, 1905. At the Military Families Hospital, which is situated alongside of the Military Hospital, Valletta, the head nurse was placed on the sick list with Mediterranean fever on June 20th, 1905. All these ladies have been engaged in attendance on patients suffering from the disease, and have, therefore, been brought into intimate contact with them. At Valletta the sisters live in the hospital quadrangle. At Cottonera there are sisters' quarters in a detached house in the hospital grounds. It has been the practice, until July, 1905, to milk the goats that provide milk for the patients on a plot of ground within a few yards of these quarters; and there is no doubt that this area was extensively fouled every day for a long period. No cases have occurred amongst the sisters at Cottonera during the summer, since the goats were removed from this spot

§ 8.—WOMEN AND CHILDREN.

During the period under review there have been, as far as I have been able to ascertain, 38 cases of Mediterranean fever amongst the families of the troops, 27 of which have been women and 11 children. The exact number of the population from which these cases were derived is not yet available, but probably varied little from that of the preceding year, when there were 567 women and 928 children present in Malta (belonging to the garrison) on an average. The cases occurred all over the island, and there was no particular prevalence in any one group of quarters.

Allusion may be made in this place to the very remarkable prevalence of Mediterranean fever in the New Misida Married Quarters in 1904. These quarters accommodate 44 families; A Block was completed and taken into use in 1903, B Block in 1904. A study of the cases shows that there were twelve cases in 44 families, of which nine at least occurred in the 24 families occupying A Block. Twelve of these quarters are on the ground floor, and twelve on the upper floor; one of the cases occurred in No. 3 on the ground floor, and eight cases occurred in the eleven quarters on the upper floor. All the adjoining quarters were affected, from Nos. 14 to 19 at the north-east end of the block; Nos. 20 to 24 were unaffected, and in B Block, to the south-east, there were two cases only amongst 20 families. It is uncertain whether Sergeant Biltcliffe lived in A or in B Block.

During the year 1904 there were, according to the Annual Sick Return, 109 cases of Mediterranean fever amongst the women and

children of the garrison. I have only been able to trace records of 67 of these, viz., 42 women and 25 children; the remainder were probably treated in quarters, and as to the diagnosis, I am unable to offer any opinion. Without attempting any statistical statement as to the prevalence in the various married quarters, it is certainly the case that nowhere else was there such an alarming incidence as in this particular block of buildings.

There are not many instances in which more than one member of the same family has been attacked. The following are all that I have been able to ascertain as occurring during 1904 and 1905. In the Misida Quarters, Floriana, Mrs. Sanders was taken ill in July, 1904, and Colour-Sergeant Sanders was admitted on August 30th; Sergeant Rogers was admitted September 21st, and Mrs. Rogers on December 13th; Mrs. Westbrook was placed on the sick list in October 2nd, 1904, and a child on January 23rd, 1905, the mother having a relapse a few weeks later.

At the Camerata Married Quarters (where about 90 families are in occupation) only one instance has occurred lately: Staff-Sergeant Lowe was taken ill in September, 1904 (presumably infected in hospital), and Mrs. Lowe in October. At St. Francis Ravelin Corporal Sullivan was admitted on July 13th, and his child fell ill very shortly after. Two children in the family of Sergeant Hammett were attacked in 1904, one in June, the other in October. At Valletta Hospital the wife of Quartermaster-Sergeant Bridges was admitted on May 27th, 1905, the child on July 28th, and Sergeant Bridges himself on August 11th. Quartermaster-Sergeant Dudman was admitted on January 8th, 1905, and Mrs. Dudman on July 17th. Conductor Fasson and Mrs. Fasson, living at Sliema, were placed on the sick list on April 23rd and May 9th respectively. The wife of Captain Challoner, living at Sliema, was first taken ill in November, 1903; the illness continued until May, 1904; on July 1st her son sickened, and a fortnight later her daughter. The wife of Major Preston, also living at Sliema, was attacked in the middle of January, 1905; her sister, and an English maid, were both taken ill about four weeks later; Gunner Hardy, a soldier servant living in the house, was admitted to hospital on April 18th.

In some of these cases some common condition was most probably the cause of the attack in both man and wife, or parent and child; but where an interval of several weeks elapses between the attacks, the likelihood of direct infection must be borne in mind. But as pointed out by Dr. Johnstone in his Report of last year, if direct infection were always an important factor in the spread,

it would be expected that a large proportion of multiple attacks in families would occur, and this has not been the case.

SECTION III.

From the foregoing account of the mode of prevalence, or behaviour, of the Mediterranean fever epidemic during the first nine months of 1905, it may now be possible to gather some outstanding facts that will help either (1) to indicate the mode or modes of spread of the infection ; or, if this is not evident, or probable, then (2) the conditions that assist in the spread of the disease may be ascertained, or shown to be probable.

§ 1.

It has been shown (1) that Mediterranean fever has appeared in all the barracks in the islands, in which are quartered any considerable body of men (say one hundred or more).

(2) Although the disease has been universal throughout the garrison, the barracks have been affected very unevenly, Lower St. Elmo having had an attack ratio of 137 and Ricasoli of only 23 per 1,000. The highest incidence has occurred in Valletta Hospital, 143 per 1,000 ; Lower St. Elmo, 137 per 1,000 ; Cottonera Hospital, 116 per 1,000. These three places have suffered far more than any others, Upper St. Elmo having only had 66 admissions per 1,000, and all the other barracks being less affected (mostly between 40 and 60), until at the bottom of the list come Verdala (29), Ricasoli (23), and Ghain Tuffieha Camp (8 per 1,000).

(3) All the different bodies of troops have suffered, except such small parties as the Military Foot Police (numbering 16), and the Mounted Infantry Staff (numbering 11) ; and one battalion of over 500 strength, but which left the island in March (King's Own Yorkshire Light Infantry).

(4) The variation in prevalence has been equally well marked in the case of different bodies of men, as in the case of different barracks. The Royal Army Medical Corps suffered to the extent of 193 per 1,000 ; the Hampshire Regiment had only 27 admissions per 1,000. After the Royal Army Medical Corps the Essex Regiment suffered most, 88 per 1,000 ; four other infantry battalions and the Royal Artillery had between 43 and 54, while the Royal Engineers had only 33, and the Hampshire Regiment only 27 per 1,000.

(5) Although the total number of admissions for Mediterranean fever increased in March, and again very markedly in May, remaining with little variation at a high level throughout the rest of the summer, this was not the case uniformly throughout the island, the maximum prevalence differing in different barracks; *e.g.*, in Lower St. Elmo it was in June, at St. George's in August, and at Cottonera in July.

(6) On examining more closely into the prevalence of the disease in different regiments, it is found that there is a considerable unevenness of incidence on different groups, *i.e.*, companies, occupying the same barracks, and living under apparently almost identical conditions. For instance, in the Essex Regiment, G and H Companies had each 19 cases; of these 38 cases, 21 occurred between May 8th and July 8th. Alongside of them, and living under the same conditions in every way, were D and F Companies; no case at all occurred in D, and only one in F Company, during this period. The difference (or *a* difference) between the two bodies was, that G and H had been living in Lower St. Elmo all the year, while D and F had been at Gozo until May 8th. Again, from the four barrack rooms in the middle storey, Nos. 9 to 12, there were admitted 16 cases up to the departure of the regiment on July 8th; from rooms Nos. 9 to 12 on the upper storey, accommodating the same number of men (about 90), there were admitted in the same period only six cases; in the former case the rooms were occupied throughout the whole time by H Company; in the latter the rooms were occupied by E Company up to May 6th, who then went to Gozo, their place being taken by F Company, from Gozo. Sixty-four cases have occurred in the four companies that have been all the time at Lower St. Elmo and Imtarfa, 17 cases in the other four companies that have been part of the time at Gozo, as well as at St. Elmo and Imtarfa. The great prevalence in the Essex Regiment appears to be connected with residence in Lower St. Elmo barracks, and especially with certain rooms in those barracks.

(7) The Lancashire Fusiliers took the place of the Essex in Lower St. Elmo on July 11th; after this date seven cases occurred in C Company, which occupied the rooms vacated by G Company of the Essex, the company that had suffered severely in the earlier part of the year. In H Company of the Lancashires, seven cases occurred after arrival at St. Elmo; they occupied the same rooms as F Company of the Essex, a company which had arrived from Gozo in May, and had suffered little; but shortly after their

arrival at Imtarfa they had three cases (presumably contracted while living in these rooms at St. Elmo); local infection seems not unlikely. The other companies of the Lancashires suffered little.

(8) The Dublin Fusiliers have occupied St. George's Barracks since March, 1904; all the companies are living under precisely similar conditions; out of 41 admissions for Mediterranean fever during the nine months, A Company has had 13 and H Company has had only one: these two companies live in the same barrack block, use the same cookhouse, latrine, urinal, and ablution rooms; they are of the same strength, yet one has had 13 cases, the other only one.

(9) The eight different companies of the Royal Garrison Artillery have suffered very unevenly; No. 65 Company has had 83 per 1,000 admissions, No. 63 company only 18·5 per 1,000. The two companies stationed at Upper St. Elmo have had many more cases in proportion than the three companies at Ricasoli; Upper St. Elmo has had a greater incidence than any other barrack except the adjoining Lower St. Elmo; Ricasoli has had the lowest incidence of any barrack.

(10) The Royal West Kent Regiment, occupying Floriana Barracks, have not suffered severely; they furnish another example of an uneven, and limited, prevalence; of 35 total admissions the origin of one is uncertain; as to the remaining 34, the *Old Barracks* (accommodating 360) contributed 23, the remaining 11 coming from the *New Barracks*, Ravelin, &c. (accommodating 563).

(11) The ratio of incidence on Hospital populations, reckoning patients and attendants together, is high, 104·7 per 1,000, but not so high as among the troops at Lower St. Elmo (137 per 1,000); at Valletta Hospital, however, it is 143 per 1,000, Cottonera showing 116 per 1,000, and the smaller hospitals much less. The attendants, taking all the hospitals together, suffer much more (193·5 per 1,000) than the patients (60·5 per 1,000); but the incidence upon the patients is not fairly comparable, as they are a very fluctuating population. Taking the two large hospitals, the incidence upon the orderlies of the R.A.M.C. is 257 per 1,000 at Valletta, and 156 per 1,000 at Cottonera, both figures being considerably higher than in any other body of troops.

(12) There has been no great prevalence of Mediterranean fever amongst the married families during the period under consideration, though cases have occurred everywhere throughout the married quarters. In comparatively few instances have two or

more members of a family been attacked under circumstances indicating direct infection from one to the other. There has been no recurrence of the remarkable outbreak of 1904 in one particular set of newly-built married quarters (Misida Bastion), which seemed to point so strongly to some strictly localised condition.

§ 2.

We may now consider what information can be obtained from the foregoing account of Mediterranean fever prevalence in 1905, as to its probable mode of spread. Infected water, infected food, infected air, are the three most obvious possible channels of conveyance; these may be first dealt with.

(i.) *Infected Water*.—The water supply of Malta has been sufficiently described in Dr. Johnstone's Report. So far as concerns the military population, there are no barracks in which there is not an ample supply of drinking water of good quality (known as No. 1 Water), in every case laid on direct from the main, and therefore free from any danger of local contamination. The same water is supplied to all the barracks. It is inconceivable that with such a supply, and such a method of distribution, there should be a prevalence characterised by the special features that have been above noted, if the drinking water were the channel of conveyance. Although it is the case that another quality of water is also supplied for ablution purposes, which is not so pure, and which therefore might be thought to be a carrier of infection, this is in the highest degree improbable. Everywhere the taps supplying this water are marked "Not for drinking," and everywhere the pure supply is quite as readily obtainable as this ablution water. Careless as the soldier may be about his health, he is not such a fool as to drink water marked "unfit" when there is a tap of good water alongside; such a case might occur very exceptionally, but not as a common practice. Moreover, in barracks that are supplied *only* with No. 1 water, such as St. Andrew's and Tigne, and in married quarters, such as the new Misida blocks at Floriana, Mediterranean fever has prevailed more extensively than in some other places, such as Verdala and Imtarfa, which have a double supply. As was pointed out by Hughes, if the inferior water supply were the channel of conveyance, "we should expect the inhabitants of private houses in the same area supplied only with the good water to be immune from [Mediterranean] fever; but this is very far from being the case."

The use of *ice*, and of *aerated waters*, is really to be considered along with the question of water supply. During the summer months the use of ice is universal amongst those that can afford it; few people in comparison drink plain water; nearly everyone drinks aerated water and ice; if any particular parcel of ice were infected there could hardly fail to be an explosive outburst of the fever, analogous to a water epidemic. There is no evidence to this effect, and no suspicion seems ever to have been excited that such was the cause. So with lemonade, soda water, and other aerated drinks that are consumed by everyone in the hot weather, there appears to be no evidence whatever incriminating these articles.

§ 3.

(ii.) *Infected Food*.—The two articles of food that appear to be the most likely channels are *milk* and *uncooked vegetables*. With regard to the latter, I regret that I have no evidence whatever: the methods of cultivation in vogue in Malta would lead one to look upon all uncooked vegetables as dangerous articles of food. Human excrement is largely used as manure, and one would regard lettuces, tomatoes, radishes and all vegetables eaten in the way of salad—*i.e.*, uncooked—also certain fruits, such as strawberries, with great suspicion. There is a fairly general consumption of such articles by the people who can afford to buy them; but by the troops they are hardly eaten at all. It is a failing of the British soldier that has been frequently commented on, that he does not take advantage of the vegetable food that is available, wholesome, nourishing and cheap, in the different parts of the world in which he serves. He has no culinary instinct, he cannot dress vegetables, and he cannot make a salad. Such things do not form part of the men's ordinary food, nor, as far as I have been able to ascertain, are they an article of consumption in the regimental coffee shops and supper bars, or in the eating-houses frequented outside barracks.

§ 4.

The question of the conveyance by *milk* is one of great importance, on account of the discoveries recently made as to the existence of Mediterranean fever in goats, and the presence of *M. melitensis* in milk of apparently quite good quality, and yielded by goats in apparently perfect health.

The facts bearing upon this question now to be related fall under three heads: (1) The conditions as to milk supply of the different bodies of troops in Malta; (2) the conditions as to milk

supply of the married families, and the prevalence of Malta fever amongst them ; (3) evidence as to milk consumption by Malta fever patients.

(1) *Conditions of Milk Supply amongst the Troops.*

The procedure adopted in the different regiments has been as follows :—

Royal Garrison Artillery—Upper St. Elmo : 65th and 96th Companies.—Only condensed milk is used ; no goats at all come into the fort, except one or two for the married people occupying the two married quarters.

Tigne : 1st, 99th and 102nd Companies.—All milk used by the troops is tinned milk, except at the sergeants' mess, where it seems that a small quantity of goats' milk has been used.

Ricasoli : 5th, 63rd and 100th Companies.—All milk used by the troops is condensed milk ; one or two goats come into the fort for the married families.

Outlying Forts.—Only condensed milk is used.

This custom of using condensed milk is, in Malta, almost peculiar to the Garrison Artillery ; it is probably due to the fact that a great number of the men have had considerable service in India, where the milk is, speaking generally, of obviously poor quality from a housekeeper's point of view, and lies under a very widely-held suspicion of impurity from the medical standpoint, chiefly in regard to enteric fever. This is now a matter of general knowledge amongst the troops in India. Condensed milk is now of such good quality, and so cheap, that the Artillery and their families use it, almost without exception, and are well satisfied with it. In the outlying forts, where the arrangements and supervision are less complete, goats' milk may be occasionally used ; but I think it must be of rare occurrence, because amongst the Artillery the feeling is, and for a long time has been, decidedly in favour of condensed milk ; the kinds used are "Milkmaid" brand and Nestle's.

* The *Lancashire Fusiliers* have used goats' milk. Since arrival at Lower St. Elmo on July 11th, no goats have been allowed inside the fort, except one or two for married families. The goats have been milked outside, morning and afternoon, the milk brought to the regimental cookhouse and immediately boiled, under the supervision of the master cook.

The *Royal Sussex Regiment* at Imtarfa use only condensed milk.

The *Hampshire Regiment* at Verdala use goats' milk ; the goats are milked outside the barracks ; the milk is brought to the cookhouse and boiled.

The *Essex* Regiment use goats' milk. When at Lower St. Elmo no goats were allowed inside the fort, except one or two for the married families. The goats were milked outside, the milk brought into the regimental cookhouse, and boiled under the supervision of the master cook. The same arrangement is carried out at Imtarfa.

The *West Kent* Regiment at Floriana use goats' milk. The goats are milked outside the barrack gate. The milk is then taken to the various cookhouses (Old Barracks, Notre Dame, New Barracks), but it has not been boiled during the greater part of the summer.

The *Dublin Fusiliers* at St. George's use goats' milk. The goats are brought to the skittle-alley in the lines, and milked under the supervision of the master cook, who is then responsible that the milk is boiled in one of the company cookhouses. It is all boiled together. The skittle-alley is cleaned out daily.

The *Rifle Brigade* at St. Andrew's use goats' milk. The goats all come to one cookhouse, and are milked under the eye of the master cook, who then sees that the milk is boiled. One or two goats are sent up to the married quarters.

At *Valletta Hospital* the goats are milked under supervision in the paved back entrance to the lower square. The milk is "Pasteurised" in an Aymard steriliser.

At *Cottonera Hospital* the goats are milked under supervision in a specially selected place. The milk is "Pasteurised" in an Aymard steriliser.

At Forrest, Imtarfa, Citta Vecchia, and Gozo Hospitals the milk is boiled.

The rule has been to boil, or Pasteurise, all milk throughout the garrison, with the exception of the *West Kent* Regiment and the Royal Artillery; the last named have used only condensed milk. As regards hospitals, this rule has been in operation for the whole of 1905 and most part of 1904. As regards troops, it is difficult to state exactly when the boiling commenced. Until recently, it was looked on as an advisable proceeding, but perhaps hardly worth the trouble, and was probably carried out somewhat perfunctorily. But from the beginning of July, 1905, there can be very little doubt that, with the exceptions mentioned, all milk consumed by the troops in barracks has been definitely boiled, that is, "brought to the boil." Horrocks has shown that an exposure for ten minutes to 68° C. (154° F.) is sufficient to destroy *M. melitensis*, naturally present in goat's milk (*i.e.*, the milk of a goat that is suffering from the fever and excreting the organism in its milk). Therefore, even supposing

some laxity in the carrying out of the boiling regulations, the milk supply of the troops (with the exceptions noted) must be regarded as having been rendered harmless. So much attention was drawn to the question of the milk supply (consequent on the discovery of the presence in the milk of *M. melitensis*) during June, 1905, and the early part of July, and the admissions for fever were so numerous throughout the garrison, that I feel no doubt that the boiling was carried out effectively, and not perfunctorily, from this time onward.

No diminution in the number of admissions occurred in August or September, when the full effect of this precaution would have become evident; on the contrary, the admissions increased from sixty-seven in July to eighty-six in August, and in September numbered seventy-seven. The regiment that did not boil its milk (the Royal West Kent at Floriana) had an admission rate for the nine months of 43·53 per 1,000, being the lowest but three of any corps in the island.

It may have been that men were infected by milk consumed outside barracks. This cannot be denied, but it is highly improbable. It is very rarely that the British soldier drinks milk at any time, and the refreshment of which he partakes during his hours of relaxation outside barracks is almost invariably of an entirely different description.

(2) *Conditions of Milk Supply among Married Families.*

A house-to-house visitation was made throughout the various married quarters, and particulars were obtained of the people's habits in this matter, the results of which are summarised in the following paragraph. The figures refer to 1904 and 1905. I am aware that statements made in answer to questions of this kind have to be taken *cum grano*, but I feel confident that the actual state of things was ascertained in the great majority of cases, practically in nearly every case. Moreover, no instance has been put down as positive, *i.e.*, no use of condensed milk only, or of condensed and boiled milk only, has been returned as such, unless there was good reason to believe that this was really the case: any case of the least doubt has been returned under the heading of "unboiled, more or less."

Out of the 322 families thus inquired into, embracing a total population of 1,213, it is seen that 441 persons consumed only condensed milk, and among these 14 cases of Mediterranean fever

occurred, giving a ratio of 31·74 per 1,000. Amongst 398 persons who drank either condensed or boiled milk, but never unboiled milk, 13 cases occurred, giving a ratio of 32·66 per 1,000, which is practically identical with the first-mentioned. Taking these two categories together, we have a population of 839, with 27 cases, *i.e.*, a ratio of 32·18 per 1,000. The remainder, 374 persons, who drank unboiled milk either habitually or occasionally, furnished 24 cases, *i.e.*, in an attack ratio of 64·17 per 1,000, or exactly twice the incidence of the protected population. Taking all the men together, 10 cases occurred among 322, or 31·05 per 1,000. All the women, 322, had 21 cases; all the children, 569, had 20 cases. The ratio for the whole population (51 cases among 1,213 persons) is 42·04 per 1,000. The women suffered the most, 65·21 per 1,000; the men the least, 31·05 per 1,000; the children very slightly more than the men, 35·14 per 1,000.

If, for the sake of argument, we leave the men out of the question (for the importance of milk as a factor in causation is likely to be much less in their case than in the case of women or children), and deal only with the remaining population of 891, we find that 277 persons drinking unboiled milk furnished 21 cases (75·81 per 1,000), while 614 persons drinking only boiled or condensed milk furnished 20 cases (32·57 per 1,000).

If we consider the children only, as being those most likely to be affected, we find that 180 drinking unboiled milk furnished 13 cases (72·23 per 1,000), while 389 drinking boiled or condensed milk furnished seven cases (17·99 per 1,000), that is, the former suffered just four times as much as the latter.

The numbers are too small to prove anything, but there is, in my opinion, a considerable presumption that, in the cases occurring amongst woman and children, the disease was introduced by infective goats' milk. It is to be noted that a disproportionate number of cases occurred in the Floriana married quarters (17 cases in 63 families, with a population of 230; three other women and one other man were attacked, but their milk supply is not known). As stated elsewhere (Section II., § 8) there is reason to believe that some special cause was in operation in these quarters in 1904. Looking at the prevalence of the disease amongst the families as a whole, in spite of all the variations in the surroundings of the quarters, in their structure and sanitary fittings, the character of the milk supply appears to have an important, and in the case of children a dominant, influence.

(3) Particulars have been obtained in regard to 155 cases of

Mediterranean fever that have occurred amongst the troops in 1905, as to their consumption of milk before being taken ill. What the men usually say is, that they "drink no milk at all"; on further questioning this resolves itself into "no milk except in tea."

In 13 cases it was definitely acknowledged that unboiled milk had been drunk, in greater or less quantity, as a beverage; in nine cases that it had been taken in tea only. In these 22 cases infection by milk is a quite possible explanation of the causation of the disease.

In 26 cases it was definitely stated that no milk *at all* had been drunk, not even in tea; or if any had been taken in tea, that it was condensed milk; and in 17 cases it was stated with equal definiteness that, although milk had been taken in tea, it was known to be boiled. In these 43 cases infection by milk must be regarded as in the highest degree improbable.

Three men stated that they had consumed a considerable quantity of milk, but that it had always been boiled, or "sterilised." These three were cases that had arisen in Valletta Hospital, where an Aymard's steriliser has been in use for two years, and the statements may be taken as correct.

The remaining 87 cases stated that they drank no milk at all except in tea; whether or no it had been boiled they were not aware. It is the universal custom in barracks to add milk to the tea in the cookhouse, before distribution; individuals, therefore, would not know whether it had been boiled or not. The practice of boiling the milk became general at the beginning of July, 1905:¹ any men admitted after the end of this month, if their milk consumption was confined to the regulation tea, are not likely to have drunk any milk other than what had been boiled. This applies to 34 cases. To these must be added seven cases in the Artillery (who use no goats' milk at all). Deducting ($34 + 7 =$) 41 from the 87 cases, there are left 46 cases, as to whom it may be said that infection by milk cannot be excluded.

It is seen that, out of the 155 cases, milk infection is quite possible in 22, and is not unlikely, or at any rate not to be excluded, in 46: while it is unlikely in 41, and in the highest degree im-

¹ The West Kent Regiment did not boil their milk until later; only three of these cases belong to this regiment, and they were admitted before June; the *omission* of the precaution did not apparently bring about any cases in this regiment during July and later, any more than its *adoption* prevented their occurrence in the other regiments.

probable in $(43 + 3 =) 46$. I regret that I have been unable to interview every one of the 487 cases that have occurred during the period under review. All the cases that I was able to get access to I did examine, with the result just stated. I have no reason to doubt that they present a fair sample of the whole; but the account is, of course, not a complete one, referring only to about one-third of the cases that occurred. If trustworthy information could be obtained as to 500 cases, the question might be settled. As it is, I consider that while the evidence as regards married families, and especially children, is fairly strong in favour of the transmission by milk, as regards the troops it is negative. It would not be justifiable to affirm that the circumstances of the milk supply of the troops, considered in relation to the fever prevalence, in any way invalidate the theory of milk transmission; but I do not find anything in these circumstances, as they existed during 1905, to lead one to suppose that milk can have had any important part, or indeed any part at all, in disseminating the specific poison during this epidemic *amongst the troops*. The experimental evidence obtained by the laboratory investigations of the Commission during the past year have been so conclusive as to the infectivity of goats' milk in Malta, that no want of proof from the epidemiological side can weaken its force; all that can be said is that milk does not explain the incidence of the disease upon the troops during this particular period. That a body of men such as the Royal Artillery, numbering about 2,000, should have had 88 cases (45 per 1,000), although, practically they drink no goats' milk at all; that of these men some companies (such as those at Upper St. Elmo), should have had an attack rate as high as 66 per 1,000; while the general attack rate has been 53, in one regiment only 27, and in a regiment that habitually partook of unboiled milk not more than 45 per 1,000 (exactly the same as in the Artillery who drank none at all)—this indicates that milk infection has not been an important mode of propagation among the troops.

A rational explanation of this lies in the fact that, as already mentioned, milk enters but very slightly indeed into the dietary of the British soldier. Occasionally and exceptionally the reverse is the case; and it is not at all unlikely that the men who have been in the habit of drinking milk (as a beverage or food, not merely in tea, &c.), have suffered largely. There are, however, no statistical data in existence as to the frequency or rarity of milk-drinking amongst soldiers. It is impossible, therefore, to say whether or no these milk-drinkers have suffered disproportionately in Malta.

§ 5.

(iii.) *Infected Air*. — Recent researches have shown (1) that *M. melitensis* is discharged in the urine of Mediterranean fever patients, being frequently present in enormous numbers; (2) that it is able to survive in a dry state for long periods when not exposed to the direct rays of the sun; (3) though it has not been demonstrated in the fæces of patients, Eyre has found it in the fæces of artificially infected guinea-pigs. There is, therefore, good ground for supposing that air containing excretally contaminated dust may bring about transmission of the disease. Such air may be "sewer air," or "latrine air," or "urinal air," or (in Malta) the air of houses, streets, roads and fields throughout the islands.

(a) The well-known observations of Carnelly and Haldane, Parry Laws and Andrews, Petri and others, have shown that the air of sewers, which are regularly and properly flushed and ventilated, is remarkably free from micro-organisms of any kind; moreover, those that are present are derived from the external air rather than from the contents of the sewer. When fermentative or putrefactive processes occur, however, with formation of gas bubbles, there is a likelihood, as Frankland has pointed out, that sewage microbes may be disseminated in the air. Tichborne considered that they might be carried about, as on a raft, by condensed vapour formed during the cold hours of the night, and dissipated when the air becomes warmed, leaving the imponderable microbe floating in the air. There is such a large body of evidence connecting outbreaks of infectious disease with the breathing of air contaminated with sewer emanations, that some such explanation is required. Notwithstanding the observed paucity of micro-organisms (and *à fortiori* of pathogenic organisms) in the extensive experiments that have been carried out, the connexion between disease outbreaks and the breathing of sewer air, or excretally contaminated air, has also been a matter of such frequent observation that the possibility of transmission of disease in this way cannot be disregarded. It is known that bacteria cannot be given off from a surface that is kept constantly moist; from a surface that is alternately moist and dry, however, they would be likely to be dislodged by various causes, such as concussion, strong currents of air, or even in the course of drying. The sewerage system of Malta has, up to the present, suffered from a very insufficient supply of flushing water; and there is no doubt that, to a very great extent, the sewer walls have been alternately wetted and

dried, and therefore in a condition to render the disengagement of sewage organisms, including the various pathogenic bacteria present in the excreta of infected persons, not only possible but likely. Amongst these pathogenic bacteria *M. melitensis* must be considered to be potentially present for a great part of the year.

In regard to barracks this inadequacy of drain flushing has also existed to a greater or less extent. At Upper and Lower St. Elmo, Floriana, St. Francis, Manoel, Tigne and Ricasoli, the amount of flushing water has been, on the whole, sufficient, and the condition of the drains satisfactory; that is to say, they have been self-cleansing, and their walls have been free from deposit. At St. James' Cavalier, Verdala, throughout the Cottonera Lines, and at St. George's, Pembroke, the flushing water has been, as a general rule, throughout the first nine months of 1905, scanty; it is probably correct to say that it has been insufficient for the proper cleansing of the drains. At Imtarfa it has been somewhat scanty, and at Gozo. St. Andrew's has only been taken into occupation during the summer of 1905; so far, there has been a sufficient supply of flushing water. There has been no scarcity of flushing water for the drains at any of the hospitals. Throughout all these barracks the drainage systems are, on the whole, of modern type, well laid, well ventilated, and well trapped; only once did I find any serious obstruction. There are, however, numerous defects of detail in construction or maintenance which require attention (as specified in a separate report), and which, unless attended to, will, in course of time, lead to dangerous conditions in the barrack drainage systems. As especially bearing on the point now under consideration—escape of sewer air—may be mentioned the following:—(1) The unsealing of w.c. traps in several married quarters in Strada Magazzini, Floriana (owing to the quarters being vacant and the closets disused). (2) The unsealing of gully traps outside married quarters at Imtarfa, owing to no water being used for washing the verandahs (to receive which these traps were provided), and to long-continued dry weather. (3) Direct communication with a drain at the side of the road within a few yards of the back gateway of Verdala Barracks, an inlet acting as an outlet, and the drain being imperfectly ventilated, so that a bad drain smell is perceptible on a much frequented roadway. (4) There has been persistent complaint on the part of the occupants of the old block of married quarters in St. Francis Ravelin, as to bad smells coming from the ventilating shafts of the Civil Government sewer, the nearest of which shafts is some 300 or 400 yards distant:

alterations have been made from time to time, some shafts have been closed, and one has been carried to a greater height; the nuisance, however, still continues. (5) At Couvre Porte there is a ventilating shaft for the Civil Government sewer, opening over the roof of the barrack, and 42 feet above it; bad smells are complained of, especially at night.

The above five instances of escape of sewer air into, or in the neighbourhood of, barracks and quarters are the only definite cases that came under my notice in making my inquiries as to the sanitary condition of barracks in Malta. In the first instance, at the Strada Magazzini Married Quarters, Floriana, at the time of my visit a stoppage had occurred in the main drain of the block of quarters. I was informed that this was not an uncommon occurrence: as two branch drains at least enter the main drain at right angles, instead of in the direction of the flow, a stoppage is not unlikely to occur from time to time; but I understand that on this occasion the actual obstruction was lower down, near to, or at, the junction with the street sewer. Such inspection pits as are provided are cemented down, so that the condition of the drain cannot be seen to and precautions taken to prevent a stoppage; consequently, it may exist for a day or two, or more, before being discovered. Meanwhile the foul air is laid on to the quarters, in which are situated the untrapped w.c.'s, and from them escapes into the small backyard, whence it gains access to the quarters above, whose windows open into this yard. Bad smells were particularly complained of by the occupants of No. 12 (Barrack Warden Budden) and No. 13 (Corporal Bellfield, Royal West Kent Regiment). Mr. Budden had an attack of Mediterranean fever in June, 1905, his two children suffer from sore throat, not severely, but chronically. Corporal Bellfield's family have not suffered from any fever or throat affection. The wife of Corporal West (Royal West Kent Regiment), who occupied No. 6 quarter (in which is one of the faulty w.c.'s) the year before, was admitted for Mediterranean fever in June, 1904. The occurrence of these two cases of the disease in connection with the faulty sanitary condition is to be noted; but no other cases have occurred in these quarters, nor have I been able to trace any connexion between the occurrence of Mediterranean fever and the other instances of sewer air nuisance just mentioned. It is true that six cases have occurred during 1903-5 in the old block of married quarters, St. Francis Ravelin, which have been thought to be due to effluvia escaping from the civil sewer ventilator, some 300 or 400 yards distant. This, however,

does not appear to be probable. Two cases were admitted from Couvre Porte in 1904, and one in 1905. This does not indicate any particular infective property in the emanations from the sewer ventilator above the roof of this barrack, undesirable as they undoubtedly are. Several cases of illness—often fatal—occurred during the summer amongst the children occupying the married quarters at Imtarfa, where drain air escaped through unsealed traps on to the verandah; but none of these were Mediterranean fever.

The theory of infection by sewer air of course presupposes that there has been previous passage of the specific *contagium* into the sewer in question. There is little difficulty in believing that this is the case in regard to the public sewers of Valletta, &c.; but in the specific instances mentioned of drain emanations in barracks the same cannot be said; there were but few cases of the disease at Verdala and Imtarfa, therefore little active contagion passing into the drains; and it would be making too large an assumption altogether to put down these cases to drain infection. In fact, the barracks where the flushing of the drains was most inadequate, such as Verdala, Cottonera Lines, and St. George's (in which, therefore, the drain air would be most dangerous), have not suffered the most severely; while the barracks that have suffered most (Upper and Lower St. Elmo, Tigne, and the two large hospitals) are those which, whatever their other sanitary shortcomings, have, at any rate, had no lack of water for flushing, no troubles with regard to their drainage arrangements, and certainly no defects leading to sewer emanations in the barracks.

The effect of breathing emanations from the public sewers in Valletta, &c., would be more likely to be evident in those who live in the crowded parts of this city, or of the other thickly populated places across the Grand Harbour. A plausible explanation would be thereby afforded of the high incidence on Upper and Lower St. Elmo, neither of which barracks can be approached without passing along crowded streets, whose inhabitants (mostly, though not all, of the poorer class) have little regard for any kind of sanitation, and are content that their closets and drains should be habitually foul and pestiferous. Verdala is, however, an almost equally bad case in this respect, yet it has suffered very slightly.

(To be continued.)

REPORT ON AN OUTBREAK OF DIARRHŒA AT THE X DEPÔT BARRACKS, ENGLAND, APRIL, 1906.

BY LIEUTENANT-COLONEL J. V. SALVAGE.
Royal Army Medical Corps.

THE central feature of this outbreak is that late on Saturday night, March 31st, or early on Sunday morning, April 1st, between one and two hundred men—or nearly a quarter of the strength—of the X Depôt were suddenly attacked by sharp diarrhœa. The large number of men attacked simultaneously in so limited a locality would lead one to expect that it should not be difficult to ascertain the cause; but unfortunately this fact, together with several somewhat similar coincidences, serves rather to emphasise than to enlighten the obscurity which yet surrounds the actual origin.

Associated facts, which were either at once brought to notice or became manifest as the enquiry proceeded, were :—

(1) The attack was strictly confined to the men and junior ranks of non-commissioned officers of the X Depôt, and amongst these it occurred irrespective of the block or room in which they lived.

(2) The members of the serjeants' mess, who mess apart, though they sleep in bunks distributed amongst the men, without exception escaped.

(3) Some fifteen assistants employed in the cookhouse were all unaffected; later it will be seen that this is perhaps less significant than at first appears.

(4) The whole of another regiment which occupied adjoining barracks also escaped.

(5) None out of the large number of children and families who live in quarters in the barracks were in any way implicated.

(6) Saturday, March 31st, was the day on which Messrs. D.'s contract for the supply of articles to the canteen, coffee shop, and grocery bar expired, and the day on which Messrs. L. took over the contract.

(7) Sunday morning was April 1st—All Fools' day.

So far as was ascertained, 193 men were attacked; possibly there were a few others, less severely affected, who did not report sick. Of these, 153 were seized between Saturday evening and Sunday morning, and forty felt no ill-effects until Sunday or

Monday, or midnight between Monday and Tuesday. The whole of these 193 men were individually questioned as to any facts which might throw light on the occurrence. The very earliest attacked was one who fell ill about half an hour after tea on Saturday evening. The latest were thirty or forty men who appear to have felt no inconvenience until midnight on Monday, or very early Tuesday morning. In the great majority of men, however, the onset was a little before or after midnight on Saturday night; some were attacked before going to sleep, or even to bed, but many had got to sleep.

The first symptom was an urgent call to evacuate the bowels, accompanied by fairly severe pains in the belly, and followed shortly, in several cases, by slight nausea—in a few, perhaps twenty or thirty, by actual vomiting—but in others there was no nausea, and there is some doubt as to whether or not one or two men passed blood. All the men agreed that there was no feeling of illness, and nothing approaching collapse, and in all cases the men at once seemed in their usual health so soon as the diarrhœa had stopped. In very many instances the diarrhœa was fairly severe; men said they were “going all night.” On the whole, the effect appeared, both to the patients and to the observer, to be similar to that of an over-dose of a medicinal purgative. All who received any kind of treatment, and were able to take care as to food, or to remain quiet, at once recovered. In a few of the men who continued to take their usual food, and to go about their accustomed duties, the diarrhœa kept on for two or three days. It is not clear that there was any marked difference between the attacks which began early and those which occurred later, but possibly more of the later cases were of a rather milder character.

It may be stated at once that the general health of these troops is excellent, the condition of the men and their arrangements, and of the barrack rooms and their surroundings, in all respects highly satisfactory, and that no similar cases, so far as could be learnt, happened amongst the civilians in the neighbourhood.

Facts pointed strongly to the probability of the ingestion of the exciting agent with food, whilst, at the same time, the total absence of anything like constitutional symptoms rather negated the idea of food poisoning, as generally understood.

The list of articles in the messing book taken to the cookhouse for the men's consumption on Saturday is as follows: Bacon, ham, cheese, tomatoes (tinned), carrots, beans, swedes, parsnips, potatoes,

peas (blue), greens, pickled cabbage, rice, flour, baking powder, egg powder, curry, julienne, raisins, herbs, jam, sugar, tea, milk, margarine, and to these must be added ration bread, beef, mutton, soup, and stew.

It must be explained that instead of every man having the same dinner, the far preferable "restaurant system" is in force here; each man goes into the cookhouse, provided with a plate and basin, and sees before him some twenty or more different dishes from which to choose; he goes to whichever he fancies, and is served by the carver of the respective dish. A man is allowed one meat, two vegetables, gravy, and one pudding; instead of meat he can have cheese or an extra vegetable. The meals provided are breakfast at 7 a.m., pea soup at 11 a.m., dinner about 1 p.m., and tea at 5 p.m. In addition, extras can of course be bought at the coffee shop, grocery bar, or canteen.

The first impulse was to blame the tea, as the last general meal partaken of before the outbreak. On pursuing the enquiries as to the articles consumed during Saturday by the individuals seized with diarrhoea, it became apparent that seven men had no tea in barracks, and, in fact, with the exception of one of these, who had a drink of water, and another who had some bread and butter, none of them had anything at all to eat or drink in the barracks after their dinner; they went out about 3 p.m. to join others who accompanied the Chaplain on an afternoon excursion, and all had tea together in town. Of these men, three became ill on Saturday night, with the majority, whilst four were not ill until Monday night. These cases seem completely to exclude the tea meal as the possible cause.

Considering next the dinner, it was found that the individual choice had been freely exercised. Of the nine meats, eight vegetables, and three puddings, which were available, it was impossible to find any one dish of which every sufferer had partaken. Whilst some men chose roast meat and gravy, others selected stew or boiled meat; and, of the vegetables, although nearly all ate potatoes, some did not; moreover the potatoes were cooked and issued in their "jackets." A few, on the other hand, instead of meat, preferred cheese and pickles with vegetables; and whilst many took rice pudding, others fancied currant or raisin pudding. Further, two men were discovered who did not have dinner on Saturday, or even go into the cookhouse for it. One of them, B. (a Roman Catholic) frequently fasts, and states positively that he had nothing between breakfast and tea; he kept his dinner check until the next day, when, having two checks, he got an ordinary meat dinner with one,

and cheese and pickles with the other ; the cheese he shared with someone else ; this man was seized with diarrhoea on Saturday night, and had diarrhoea all night ; he was better on Sunday morning, but got bad again on Sunday night, possibly as the result of his indiscretion in eating part of two dinners on the one day immediately after the purging. Incidentally, this case is an example of the small degree to which the men's general sense of well-being was affected by whatever it was which set up the diarrhoea. The second man, O., felt hungry at 11 o'clock in the morning, and purchased some bread and ham at the coffee shop, so that at 1 o'clock he was not hungry and did not go for his dinner ; he subsequently lost his dinner check ; this man had diarrhoea on Sunday night, "going five or six times." It therefore seems impossible to blame the dinner meal. Coming now to the soup served at 11 a.m., fully one-third of the affected men did not partake of this, which must therefore remain free from suspicion.

The next previous meal in order of time was breakfast, consisting of bread, margarine, and tea ; this was the first meal of which all the affected men partook, though even with regard to this, one man, M., who had diarrhoea during Saturday night, stated that he only drank a mouthful of the "tea," either at breakfast or tea, as he did not like it, thinking it tasted of "dripping ;" he, however, ate bread and margarine. The actual constituents of the breakfast were tea, sugar, water, milk, bread, margarine. Tea, in unopened one pound packets, and sugar, in bulk, are obtained from the grocery bar. The infusion is made as follows : Tea cans are placed in a double row ; into the cans of the first row tea is emptied direct from the packets, into those of the second row sugar is placed ; boiling water is poured on to the tea and allowed to stand a little while ; the fluid is then poured off into the can containing the sugar, the tea leaves are again infused with more boiling water, the two brews mixed and the milk added. It seems a little unlikely that the packets of tea, or the sugar, should have been, originally, at fault. The water seems quite above suspicion ; apart from its having been boiled on this occasion, there is the fact that the children and families in the married quarters, the members of the officers' and serjeants' messes, and a second regiment in adjoining barracks, all remained entirely unaffected, although they received the same supply. The milk is delivered by the dairymen at the cookhouse, shortly before it is required ; the man leaves his house with one churn of milk, a portion of this is taken out and left at another regimental cookhouse and sergeants' mess, part is sold to the

married quarters and to civilians, and part is taken to the cookhouse under consideration. No cases of illness were known of, either in the second regiment, in the married quarters, or amongst the civilians; therefore the milk must, I think, be excluded as the cause. The bread was the usual ration bread, always found to be of good quality, and the baker informed me one delivery of flour lasts a week; this day's bread was made from the last day's supply of a particular delivery. The margarine was sent to the cookhouse from the grocery bar in unopened boxes, each box containing twenty-four separate one pound packets; nothing unusual was noticed about it; a small piece was obtained and sent to London for analysis; unfortunately, this was the only article available at the time suspicion fell upon this meal. Excepting milk, the margarine is the most likely constituent of the breakfast to have naturally contained deleterious substances, but as it was done up in one pound packets several of these must have been similarly affected in order to have produced the results which ensued.

It is difficult to resist the conclusion that the offending substance was distributed with this breakfast meal; and, if so, the tea becomes conspicuous as a likely vehicle; but without laying too much stress on an individual instance amongst so large a number, the case of M. should not be overlooked; this man suffered on Saturday night, in a manner indistinguishable from that of any of the others, and yet he states positively that he drank only a mouthful of his tea.

Again, none of the thirteen or fourteen cooks were affected, and, by the law of averages, at least three of these should have been attacked. Seeking an explanation of this anomaly, I was informed that few of the cooks usually took anything, either tea or bread, in the cookhouse in the early morning. This being the case, the few who did partake of any might by fair chance remain exempt, since three out of four of the total strength of the dépôt escaped; moreover, if too great an importance be attached to the immunity of the cooks we should be driven to the decision that the food could not in any way be at fault, a conclusion which, under the circumstances, seems to be almost a *reductio ad absurdum*.

On the whole, I fear it is now impossible to arrive at a quite certain conclusion, and I do not feel entitled to give any more definite opinion than can be formed by anyone who considers the facts related above.

ON THE SYMPTOMATIC TREATMENT OF ENTERIC FEVER.

BY COLONEL R. H. FORMAN AND CAPTAIN ROBERT SELBY.

Royal Army Medical Corps.

DURING 1904 a somewhat severe epidemic of enteric fever broke out in Bangalore, the first case occurring on May 24th, and the last on September 7th. In all there were 68 cases with four deaths, which, as mortality runs in India, is decidedly low. One of us, Captain Selby, was in immediate charge of the fever wards; the other, Colonel Forman, was in command of the hospital, and in daily consultation with him.

The first symptom we would wish to direct attention to is that of hæmorrhage and its treatment by the administration of adrenalin. Of the 68 cases 10 had hæmorrhage, more or less severe, most of them more than once, and in no case did death ensue from it, *per se*. It is true that three of these cases died, but hæmorrhage was not the cause of death, as the *post-mortem* showed. We quote below very briefly the salient points of all these cases, and others can judge whether hæmorrhage was the cause of death and whether adrenalin had any effect in controlling this grave, and often fatal, symptom. We are fully aware that so few cases are far from furnishing sufficient data upon which to base any reliable deductions, but feeling, as we do, that in this drug we have a powerful means of controlling bleeding, we can but hope to show a sufficiently strong case to induce others to give it a trial. And, parenthetically, it may be added, that it is well nigh impossible to convey to others those numerous, often trifling, indications, only appreciable at the bed-side, which tell the observant man that a given treatment is acting beneficially. Certainly neither of us possess the necessary facility of diction, but to every doctor it is so much a truism as scarcely to call for remark.

The method of administration was: On the first sign of hæmorrhage to give a quarter of a grain of morphia hypodermically and thereafter fifteen minims of adrenalin (1 in 1,000 solution, Parke, Davis) in an ounce of water every two hours, four to six doses being given according to the severity of the case.

CASE 1.—A severe, protracted case with relapse, and some dysenteric symptoms during convalescence. Two slight hæmorrhages occurred during the night of the fifteenth to sixteenth day of disease. A quarter of a grain of morphia was given hypodermically and six doses of adrenalin, ice being applied to the abdomen.

Nothing occurred until the nineteenth day, when a streak of blood was observed. After two doses of adrenalin there was no further hæmorrhage until after the fifty-first day, when six more doses of the drug were given. Thereafter there were no further hæmorrhages.

CASE 2.—A malignant, fatal case, with lungs involved, high temperature, albumen in urine, involuntary evacuations, delirium, subsultus, progressive asthenia and emaciation. On the twenty-first day hæmorrhage occurred. A quarter of a grain of morphia and four doses of adrenalin were given. There was no further hæmorrhage for eighteen hours, when it again came on, in spite of which stimulant was pushed freely to combat threatening cardiac failure. No drug was given. Three hours afterwards hæmorrhage (four ounces) occurred. One-sixth of a grain of morphia and four doses of the drug were given, brandy still being pushed. There was no further hæmorrhage before death, four days afterwards. *Post-mortem* examination. Recent double pleurisy and pneumonia were present, and the characteristic ulceration in ileum; no blood in the bowels, liver was fatty, and kidney capsules adherent. •

CASE 3.—An extremely grave case in a highly neurotic patient, with lung complications, high prolonged fever and extreme emaciation, with deep sloughing bed-sores on all prominences. At 7.45 p.m. on the twentieth day hæmorrhage occurred (four ounces), and again an hour later. At 7.45 a quarter of a grain of morphia was given and a dose of adrenalin every two hours, but at 4.45 a.m. further hæmorrhage (twelve ounces) came on with collapse. Nine doses of the drug altogether were given. No further hæmorrhage until the twenty-eighth day, when it came on again (three ounces) at 4 p.m. The usual morphia and six doses of adrenalin were administered, but at midnight the hæmorrhage (twelve ounces) returned. Morphia and two doses of adrenalin were given, making seven doses in all. The effect of the hæmorrhage was plainly marked, the condition being very grave. Again, on the thirtieth day, hæmorrhage appeared (one ounce). Morphia and four doses of the drug were given. By this time the patient's condition was pitiable, but there was no more hæmorrhage, and although the prognosis was as bad as it well could be, he ultimately recovered after a protracted convalescence.

CASE 4.—A mild, somewhat atypical prolonged case. Two hæmorrhages occurred, one on the twenty-eighth day (four ounces), the other on the twenty-ninth day (three ounces); on each occasion morphia and six doses of adrenalin were given. There were no

further hæmorrhages, and he made a good recovery, being discharged to duty on the eighty-first day.

CASE 5.—A peculiarity about this case was that the man gave a clear history of a severe attack of enteric fever in South Africa, for which he was invalided. Yet there was no doubt about the diagnosis in this second attack, which was exceptionally severe, and reduced the patient to a mere skeleton. His temperature was not quite normal one hundred days after the onset. Slight hæmorrhages occurred on the thirteenth, fifteenth and sixteenth days; morphia and four doses of adrenalin were given the first time, on each subsequent occasion morphia and six doses of the drug were administered, two of the doses expectively. On the twenty-ninth day it returned (four ounces), when morphia and four doses of the drug were given. Thereafter no further hæmorrhage occurred. The patient was ultimately invalided.

CASE 6.—A mild case in an officer, aged 36. Hæmorrhage (ten ounces) occurred on the twentieth day. Morphia and six doses of adrenalin were given, and afterwards calcium chloride, fifteen grains every hour for four hours, and repeated next day. There were no further hæmorrhages. The condition of the patient was very grave for forty-eight hours after the bleeding.

CASE 7.—A malignant fatal case, with lung complications. At 2.30 a.m. and 7.30 a.m. on the seventeenth day slight hæmorrhages occurred. On each occasion morphia and adrenalin were given, altogether nine doses of the drug. Thereafter there was no more hæmorrhage, though stimulants had to be pushed. He died on the twenty-fifth day. *Post-mortem*: there was double pneumonia and numerous deep enteric ulcers, three inches of the lower part of the ileum being practically gangrenous; there was no blood in the bowels.

CASE 8.—A fatal case with perforation. There was very slight hæmorrhage on the ninth day. Morphia and six doses of the drug were given. There was no further hæmorrhage. The patient died on the fourteenth day. *Post-mortem*: general peritonitis was present, the appendix being gangrenous, and there were numerous deep comparatively recent ulcers which had eaten deeply into the intestinal wall and had only the serous coat as a base; the site of perforation was not found. There was no blood in the bowel.

CASE 9.—A moderately severe case. Slight hæmorrhage occurred on the eighteenth day. Morphia and four doses of the drug were given. There was no return of the hæmorrhage and the patient recovered.

CASE 10.—A very mild case. A trace of blood was observed on the twenty-third day, which did not recur after four doses of adrenalin.

According to authorities hæmorrhage occurs in from 3 to 5 per cent. of all cases, and proves fatal in from 30 to 50 per cent. of the cases. In this outbreak we had hæmorrhage in 14.70 per cent. of the cases, so that from four to seven should have died, and we submit that none died from this complication. Note that in the three fatal cases death occurred respectively, four, five and eight days after all bleeding had stopped, and that the *post-mortem* showed no internal hæmorrhage, but other pathological changes which fully accounted for the fatal issue. We repeat that we make no claim to dogmatise on such limited data, whether it was coincidence or good fortune we are not prepared to say, but we do suggest that the apparent results were such as to warrant extended trial. It is asserted that adrenalin does control hæmorrhage, and these cases, so far, support that assertion.

The second symptom we would wish to direct attention to is that of temperature and its control by the bath. We are perfectly aware that there is nothing new in this treatment, but we do think that in spite of many convincing proofs of its efficacy, Royal Army Medical Corps Officers as a rule have failed to appreciate the powerful therapeutic agent they possess in bathing, judiciously used; and when we say bathing, we do not mean sponging or packing, but complete immersion of the whole body. There is a right way, and many wrong ways, of bathing a typhoid patient, and perhaps the simplest way of illustrating the former is to quote an official communication made by one of us some two and a half years ago, which resulted in special baths being supplied to certain hospitals in India. Much of it is taken from a small book, "The Cold Bath Treatment of Typhoid Fever," by F. E. Hare, M.D., late Resident Medical Officer, Brisbane General Hospital, Queensland (Macmillan and Co.), published in 1898. Statistics are admittedly fallacious and liable to be misinterpreted, but Dr. Hare is ultra careful in their application, and his argument carries conviction. These arguments cannot be reproduced here (they will be found in detail in his book); we merely append one general table explaining that in the context any possible statistical error is discounted.

It will be observed that under the bath treatment the percentage case mortality is reduced by one half, and that this is not peculiar to Brisbane one of us is in a position to assert, from an experience of the treatment dating from 1885. Taking, for example, the Army

Medical Report for 1898, we have in India 2,375 admissions for enteric and 654 deaths, *i.e.*, 27·5 per cent.; in our small group of 68 cases the mortality is 5·8 per cent. If then the bath treatment had been universally adopted in India in 1898 and had been as successful as in Dr. Hare's hands, and there is no reason why it should not have been, then some 325 lives, at a low estimate, would have been saved in that one year alone.

TABLE A.
Expectant Period.
Brisbane General Hospital, Queensland.

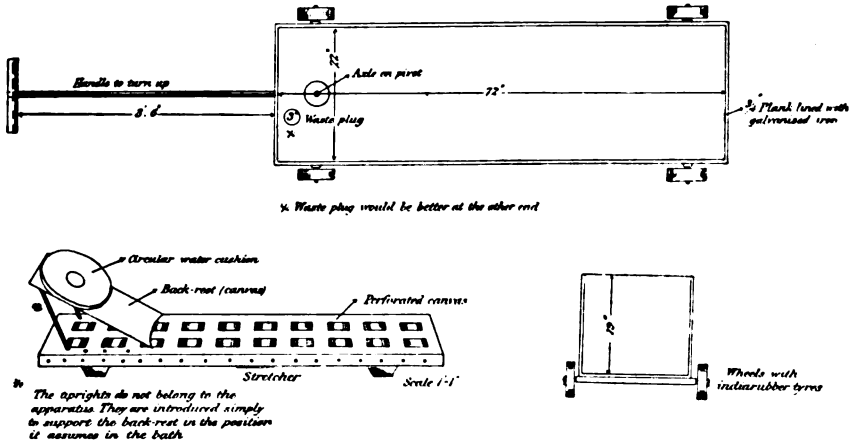
Year	Number of cases	Deaths	Percentage mortality
1882 (From May 15)	147	25	17·0
1883	273	40	14·6
1884	575	89	15·5
1885	369	49	13·3
1886	464	68	14·6
Total ..	1,828	271	Average 14·8

Bath Period.

Year	Number of cases	Deaths	Percentage mortality
1887	239	27	11·3
1888	339	23	6·8
1889	595	42	7·0
1890	160	16	10·0
1891	137	7	5·1
1892	104	7	6·7
1893	50	2	4·0
1894	79	1	1·3
1895	69	8	11·6
1896	130	10	7·7
Total ..	1,902	143	Average 7·5

Various reasons are put forward in opposition to the treatment—liability to pneumonia, danger of perforation, heart failure, &c., &c.; all these Dr. Hare shows to be fallacious, and with that opinion we are entirely in accord. But there is one objection raised that has weight, *viz.*, that the treatment is troublesome to both the patient and attendants. That is so when proper appliances are not available, but when they are, the treatment is not only less irksome but distinctly less troublesome than sponging or packing. It is far more efficacious in controlling high temperature, and in that it has a

very pronounced effect on the nervous symptoms; much anxious watching and restraint are avoided. A bath was made locally for this hospital, of which a sketch and description is appended.



(1) The bath, constructed of three-quarters of an inch planks lined with galvanised iron, rectangular in form, seventy-two inches long, twenty-two inches wide, and nineteen inches deep. When ready for use it should be about two-thirds full and contain about seventy-five gallons. At one end of the bottom is a waste plug three inches in diameter. It is mounted on four wheels, one pair (the larger) fixed, the other pair attached to a revolving under carriage. From the front of the latter projects a hinged handle for convenience of moving. The best wheels are the patent-tired trolley wheels made by Warren and Co., London, and the axles should be turned to ensure silence and smoothness of motion.

(2) The stretcher, made of perforated canvas stretched between two light poles of wood, the extreme ends of which are connected by light galvanised iron cross-bars. The poles should be as thin as possible to allow of the patient being easily rolled on and off when the stretcher is laid across the bed. Its dimensions are such that it fits loosely the bottom of the bath, with sufficient space to admit the fingers for the purpose of lifting.

(3) The back rest, a light wooden frame filled in with canvas a little narrower than the stretcher so as to rest comfortably within the poles. It forms an oblique rest for the head and shoulders, and should project from six to eight inches beyond the head of the stretcher, so that when the latter is lowered into the bath it catches

the end and mechanically forms the back rest. It is well to state, to avoid error, that the back rest is not attached to the stretcher in any way.

(4) Circular water cushion with central diaphragm for the head. Failing the cushion, a large sponge acts very well.

(5) Piece of board (thirty inches by ten inches). This is used for two purposes, *viz.*, placed end on, at the foot of the bath, to form a sloping end to raise the feet out of the water, when it is desirable not to chill the extremities too much, and placed across the bath to rest the stretcher upon. By this means two orderlies can easily bathe a succession of patients without fatigue to themselves, or any exertion on the part of the patient.

It might be as well to briefly discuss further some of the objections which in our experience are urged against the bath treatment.

(1) Dislike to it on the part of the patient. A certain number of men do dislike it and object; many, however, like it and even ask for it; most are indifferent; and there are very few indeed whose objection reaches the point of opposition. And in this connection we may say that it is seldom necessary to employ the "cold" bath; "tepid" is quite sufficient, and we usually had the bath at 85° F., and even added hot water to it after immersion up to a maximum of 92° F. Thus, one frequent cause of objection—the shock of cold water—is removed. The warmer water takes longer, especially at first, to produce defervescence; but that is not of much consequence, and experience proves that the latter baths accomplish the desired object much more rapidly as a rule, and the effect is more lasting.

(2) Fear of it, and opposition to it, on the part of the nurses, and, for that matter too, of the doctors. Shivering, especially in patients who have suffered from malaria, frequently alarms the inexperienced, but the heating of the bath as above stated largely discounts this. Though it persists, however, there is no need to be alarmed about it; even though the face becomes pinched and slightly cyanotic, no harm ensues except the discomfort. Similarly, both doctors and nurses get frightened at the condition of the pulse, and jump to the conclusion that cardiac failure threatens as a result of the bath. We can only say that this is want of accurate clinical observation. It is curious how few people are aware that in a healthy man the primary effect of a bath is to lower the pulse tension temporarily, and this natural physiological effect is somewhat more pronounced in the typhoid patient, plus the fact that, in the latter, the comparison with the antecedent hard bounding pulse,

so frequently present, is striking and gives rise to an erroneous impression. As a matter of fact, we believe that the bath, far from favouring cardiac failure, wards off that fruitful source of fatality, and if any one will note the pulse in a succession of cases half an hour after the bath, we assert that this contention will be verified.

(3) *Pneumonia*.—If the pneumonia of enteric is a septic complication, as undoubtedly it is, how can a bath increase that susceptibility? It does not, and, in our opinion, the presence of lung complication does not contraindicate the use of the bath, short of pathological conditions that call for rigid physiological rest.

(4) *Perforation*.—We doubt whether any slight movement of a patient with proper appliances could favour this almost necessarily fatal complication. The natural peristalsis is surely a more potent factor, and the bath can have no influence upon that. In our group of 68 cases and four deaths, only one of the fatal cases (case No. 2 above) was treated with the bath. The fatal case of perforation (case No. 8 above) reported sick late in the disease, and his condition was such as to contraindicate even the slight exertion called for in bathing. He died five days after admission.

Though probably familiar enough we may just indicate briefly the method of bathing. The bath is placed at right angles to the foot of the bed, the patient stripped and a towel adjusted round the loins, the stretcher and head rest are then laid diagonally across the bed, the patient having previously been moved gently into a diagonal position also; he is then half lifted, half rolled on to the stretcher by two attendants, one at his head, and the other at his feet, and is warned to remain passive himself. The head and back are then sponged with cold water; the stretcher is lifted gently and lowered into the bath, the head rest mechanically adjusting itself in the process; the foot rest may or may not be placed in position as circumstances dictate. The temperature of the water need not as a rule be lower than 85° F. The mouth temperature is taken at intervals of three hours, and if it is over 103° F. the patient is bathed. The duration of the bath varies; twenty minutes will usually suffice, but at first it may require even an hour. A peculiarity which is frequently noted is, that whilst at first it may be necessary to give four or even more baths in the twenty-four hours, this is seldom necessary for more than a few days; the baths, in the majority of cases, appearing progressively to keep the temperature more and more within the limit. A fall to at least 101° F. should be aimed at, and, if the observation is made, it will often be found that the temperature continues to fall for sometimes as much as an hour after the bath. The advantages of the bath are: The

amelioration of the nervous symptoms—most patients sleep quietly after a bath and delirium is markedly diminished; the digestion appears to be improved as evidenced by the dry brown cracked tongue becoming moist and cleaner; and last, but not least, the systematic control of the temperature must retard the rapid metabolism which is so marked a characteristic of all fevers, and which, through its wasting effect on the tissues in general, and on the heart muscle in particular, must increase the risk of the patient.

Looking facts in the face, no one can assert that the course of enteric fever can be cut short by any known method of treatment, and until such a discovery is made the treatment must of necessity be symptomatic. Intestinal antiseptics, so-called, have been tried, and a host of other remedies, but with little or no result, for the case mortality remains much as of yore, and that is very high. In the bath, scientifically used by skilled men, we believe that we possess a therapeutic agent which, though not by any means new, has been far too little exploited. The experience gained in Brisbane by an experienced and competent observer is surely not one that should be ignored, and in the small group of 68 cases we here quote, the results are most encouraging. One of us at the beginning of this outbreak was prejudiced against the use of the bath, believing as he did the statements, many of them rash and ill-digested, that have been urged against it; but yielding to the suggestion of his colleague, who had used it extensively for twenty years back, he tried it, and that more and more freely as the epidemic advanced, and experience removed his misgivings, the result being that he is now fully convinced of its high value, and of the chimerical nature of the objections raised against its employment. Last, and very briefly, we should like to say just a word in favour of trional as a hypnotic in enteric cases. Anyone who has suffered from the disease must know how terrible is the insomnia which is so frequently a concomitant. In our hands trional has proved most efficacious and superior to any other hypnotic, though at different times we have tried the whole gamut. Happily in these days the physician does not as erstwhile combat nature by denying water to a cholera patient, or hypnotics to an enteric. There is still a vivid and but too painful personal recollection in the experience of one of us, battling through an attack of enteric (called simple continued fever, by the way), and left to the tender mercies of one of those mediæval wiseacres who looked upon a hypnotic as anathema and pinned his faith in mist. diaphoretic. There is a sort of negative satisfaction in the knowledge that he ultimately closed his career in a lunatic asylum.

ESSAY ON MEDICAL ARRANGEMENTS IN WAR.

BY LIEUTENANT-COLONEL C. W. S. MAGRATH.

Royal Army Medical Corps.

ADMINISTRATIVE.

THE Director-General, Army Medical Service, is the advisor of the Army Council on all subjects connected with the physical welfare of the Army, and on the outbreak of war, he will, when required to do so, give his opinion in writing on all matters connected with the country, climate, productions, rations, clothing, shelter and sanitary arrangements and precautions, and on all other matters bearing on the health of the troops. He arranges under central administration all matters relating to medical and surgical stores, supplies, equipment, ambulance and medical services to accompany the Army, and nominates the *personnel* to different posts and hospitals. He will issue to the Principal Medical Officer of every force on active service such code of instructions for his guidance in all matters connected with the above as he may see necessary to meet the special circumstances of each case.

The Principal Medical Officer, Forces, is on the staff of the General Officer Commanding, and advises him on all matters connected with the health and medical arrangements of the Army. He is responsible for the entire arrangements for the prevention of sickness, the removal of wounded from the field, and the general care and treatment of all sick and wounded throughout the entire forces. He requires four Staff Officers: (1) Sanitary Officer; (2) one for field medical arrangements, communications and base hospitals, and transport of sick and wounded; (3) one for *personnel*; and (4) one for supplies and to act as Orderly Officer. The officer in medical charge of Headquarter Staff should not be included.

A Principal Medical Officer, Field Army, should be appointed to each army in the field. Where there are more than one the need for this is obvious, but even where there is only one army the services of this officer are required to work the divisional arrangements and leave the Principal Medical Officer, Forces, free to exercise his proper function, the ordering and supervision of the whole. The Principal Medical Officer, Field Army, requires one officer as Secretary. A Principal Medical Officer is appointed to each cavalry and infantry division. He forms part of the

divisional staff, and is responsible for all sanitary and medical services within his division. He will take care that his field ambulances do not become blocked by sick, and will keep the Principal Medical Officer, Field Army, and Principal Medical Officer, Line of Communications, constantly informed of the number of sick and wounded requiring transport, and the kind of transport required. He requires a staff of one Sanitary Officer and one Secretary.

A Principal Medical Officer will be appointed to the staff of the General Officer Commanding Communications. He will control the whole of the medical arrangements from, and including, the base, up to the field ambulance. He is responsible for the transport of medical and surgical stores and *personnel* to the front, and of sick and wounded to the rear. He requires one Staff Officer as Secretary, one as Orderly Officer, one at each point of concentration as "Field Inspector," and a certain number as "Line Inspectors," the number depending on the length and difficulty of the line of communications.

The Principal Medical Officer, Base, is under the Officer Commanding, Base, and the Principal Medical Officer, Communications. He controls all base establishments, including hospital ships, and is the accounting officer to the War Office for the clothing and equipment of all Royal Army Medical Corps men proceeding to the front. His staff should be: one Staff Officer as Secretary and Embarkation Officer; one in charge of the Depôt of Medical Stores, with one Quartermaster as storekeeper; one Commanding Depôt Company, Royal Army Medical Corps, with one Quartermaster for pay, clothing and equipment; and one Assistant Matron, Q.A.I.M.N.S., in charge of Depôt Nursing Sisters.

It has been suggested that a statistical office, for the compilation of all medical statistics of the war, and also a casualty office, for dealing specially with the whereabouts of all men not at duty, should be established at the base. If this were done, these offices would be under Principal Medical Officer, Forces.

FOR PURPOSES OF ILLUSTRATION.

It is presumed that the war is over-seas, against an enemy equipped with modern armament, and sufficiently powerful to call forth our full resources; and also that some extent of territory, or at least a port of debarkation, is already in our hands. It is in the early days of such a war that the pressure is greatest, in proportion to the resources at hand to meet it, and that a break-

down in the medical arrangements is most liable to occur. Preliminary preparation is of the greatest importance, and the time available for it is usually all too short. It should be pushed forward with strenuous speed, and the resources of the country utilised to the utmost without waiting for aid from home, so that the demands which will occur immediately on the outbreak of hostilities may be met promptly and effectively. It should not be forgotten that the force from England will bring sick with it, and, as far as our own borders, medical aid should precede, not follow, the advancing army. Of course there may be several ports, and several obvious lines of advance, and preparation must be made on all of these in proportion to their relative importance, a matter giving scope for the exercise of great judgment and foresight. One line of advance, however, will suffice as an example.

Of the first importance is the establishment of a General Hospital at the port (which I will call the "Embarkation Hospital," to distinguish it from other general hospitals which may hereafter be established at the base), provision for a General Hospital on rail or river, as near the existing frontier as is practicable and safe, and a connecting line of Stationary Hospitals at such points as may be required between the two, together with medical store depôts at the base and front. Also (and I would emphasise the importance of this) the establishment of a large hospital at the base, quite apart from the "Embarkation Hospital," for the reception and treatment of sick from England, and for the slighter cases, which in the early days may be sent down from the front, but do not require to be invalided.

Equipment for General and Stationary Hospitals, and Field Ambulance for the needs of the garrison on a war footing, should be available in the country. If not they must be cabled for, but if the imminence of war is practically assured, and its magnitude correctly estimated, no time should be lost in selecting and preparing a site for the "Embarkation Hospital," and (if authority can be obtained) erecting subsidiary buildings, and constructing a siding from the railway to connect it with the terminus and docks. If such a siding is possible, it will not only expedite the removal of sick and wounded, but will pay its cost later on by saving in transport, and will facilitate traffic by relieving the main line of stationary ambulance trains. In emergency, provisional tentage may be pitched, but the construction of hut wards should be commenced as soon as possible. Such procedure is far preferable to the occupation and alteration of possibly insanitary buildings on inconvenient sites, and will probably prove cheaper in the end.

Suitable buildings should be obtained for a "Medical Store Depôt at the Base," and a staff appointed. The existing military hospital may perhaps be expanded to receive the sick from England, or a camp hospital of at least 600 beds may be established, preferably on a branch line of rail or a tram terminus some little distance from the town. Great care and judgment will be required in selecting a site for the advanced General Hospital, and it should only be done if the territory in our hands is fairly extensive. It will, of course, be on the rail or river leading to the port, and, as this point will certainly be held by our troops, preparations for it may be pushed far without attracting attention, since a hospital of some sort is an obvious necessity, and a very small one may be made to cover the erection of operating room, kitchen, stores and other subsidiary buildings, as well as the collection of provisional tentage, bedding and medical and surgical stores for a General Hospital, and advanced Depôt of Medical Stores.

Lines of communication hospitals must be formed by the expansion of existing military hospitals, or the establishment of stationary hospitals, where required. They will be needed to relieve the front of the early pressure of sick, before the General Hospital there is opened.

Ambulance coaches must be equipped and attached to ordinary trains, and ambulance trains assembled, equipped and held in readiness at important junctions. A good working scheme of communication and transport of sick from front to base must be drawn up, and perfected as far as possible, all weak links in the chain being specially noted and provided for. Where, as is sometimes the case, both rail and river communication exist, preference should usually be given to the latter, if suitable boats can be obtained. It is somewhat slower, but much more comfortable for wounded men. It gets them out of the way of the advance and leaves the rail free for effective troops.

Field ambulances must be equipped, completed as far as possible in *personnel*, and attached to the brigades already in the field; medical officers equipped and attached to each unit. An Administrative Medical Officer must be placed in charge of the lines of communication, with a suitable staff, and a provisional Principal Medical Officer with the field force appointed. Royal Army Medical Corps Officers must be placed in charge of the two Base Hospitals, advanced General Hospital, and of their medical and surgical divisions. The stationary hospitals should also be in charge of

Royal Army Medical Corps Officers ; but early application for authority to employ civil assistance should be made, and the staffs of all but the advanced General Hospital should, for the present, be completed as far as possible by civilian surgeons and nurses. We have realised that, with our limited establishment, civil assistance *must* be employed, and it is in these hospitals that it can be used to the best advantage ; also, all these civilians have to be trained in military work, and the earlier their training is begun the sooner will they become efficient and a real help, instead of somewhat of a hindrance.

In addition to civilians actually employed, lists should be opened and a record kept of all civil doctors and nurses willing to serve. The resources of the country at large, and especially in the neighbourhood of military posts, should be examined and estimated with regard to the available supply of drugs, surgical material, transport, food (especially milk supply), workmen and building materials for hut hospitals and stores.

Stretcher or dooly bearers should be enrolled, and their training commenced forthwith. I use the word "training" advisedly, not drill. To teach them to lift wounded, carry wounded, load ambulances, and the rudiments of discipline is all there is time for. The distance and weight should be gradually increased until they really *can* carry, and when that is achieved they will be useful bearers. Every effort should be made to equip the advance Medical Store Dépôt as thoroughly as possible, for very little will be able to be got up when the real rush begins ; but all these preparations must be made methodically, quickly and quietly, without fuss or ostentation, seeming to merely follow actual movements of troops with necessary medical aid, while in reality providing for the future needs of a larger force.

The importance of preliminary preparation cannot be over-estimated, and were it possible to carry it out thoroughly, the whole machinery of medical aid would glide into motion with the opening war smoothly and effectively ; but the practical difficulty of making these preparations is enormous. Possible lines of advance might be unmasked by the rash pushing forward of large hospitals, and by too obvious activity ; still, there are ways by which hospitals may be quietly rendered capable of rapid expansion, and stores and men assembled at important points, without attracting undue attention, or giving information to a prospective enemy. But the ordering of these matters requires sound judgment and ripe experience, as well as the confidence and co-operation of the

local authorities, both civil and military. There is also the question of economy. To move large quantities of stores and make expensive preparations on account of some political *impasse*, eventually settled by diplomacy, would be a most serious error; and, therefore, a very special and intimate appreciation of the situation is required. And, lastly, there is the *vis inertiae* of peace to be overcome. At such times it is difficult for a comparatively unknown man to get his indents complied with, and the needful expenditure sanctioned, although in the event, such timely expenditure might save many thousands of pounds, and the prompt despatch of stores and *personnel* avert something like disaster. For these reasons the officer on whom this onerous duty falls should possess some better qualification than merely being "the man on the spot"—a qualification which may be further discounted by his having so recently arrived on it as to have no local knowledge whatever. He should have experience of war and a sound grasp of the actual needs of war; should possess tact, energy, judgment and personal influence, as well as perfect health and bodily and mental vigour. He should be in close touch with the Headquarter Office at home, and with the local, political and military authorities, and should have the confidence of all three. He should possess a thorough personal knowledge of the territory in which the preliminary preparations must be made in the event of war; and as complete a knowledge as possible of the country beyond, into which operations may be carried. For this purpose an officer, carefully selected as possessing the necessary qualifications, and one not too old, say a Senior Major, or Junior Lieutenant-Colonel, might be told off to each of our more important possessions, on the borders of which war may sooner or later be expected, and given special facilities for studying its topography and resources, and, as far as possible, those of the hinterland as well. He should be accredited to the Local Government, and in close touch with the Headquarter Office, from whom he should receive every assistance. He should draw up plans and estimates of requirements for all medical arrangements between the ports and the frontier, paying special attention to the varieties of field ambulance transport which would most suitably meet the topographical difficulties of the different areas over which operations might extend. Later, he might have an understudy of Captain's rank, but, in the first instance, his knowledge should be acquired by himself alone, in boats, on horseback, and on foot, and not merely gathered from leisurely railway journeys and the study of

maps. This knowledge once gained, his services need not be absolutely confined to the country in question, but, when absent from it, he should be required to keep himself informed of all political and commercial changes, projections of lines of rail, opening of new ports, changes in the steamer traffic connecting it with England or with Colonial ports which might be used as sanatoria. When war threatened, if not already in the country, he would at once proceed there with very full powers to make all needful preparations, pending the arrival of the Principal Medical Officer, Forces, to whose Staff Officer he would afterwards be attached. The appointment of such a Special Service Officer would lessen the chance of distinction of the Senior Medical Officer who happened to be on the spot, but it would eliminate several other less desirable chances, and his plans being already in the Head-quarter Office and his requirements known, preparations at home and abroad would be simplified and synchronised.

With the actual outbreak of war the need for secret preparations to some extent ceases. The "Embarkation Hospital" should be in working order. Civilian assistance, both surgical and nursing, should be utilised to the utmost, in order to set free as many Royal Army Medical Corps Officers and men as possible for the front. This is not only advisable, but will probably be the only course open, every available officer and man having already been attached to the troops holding the country, and to the field ambulances acting with them, or placed in command of General and Stationary Hospitals, Medical Store Depôts, or acting as Principal Medical Officers, Lines of Communication.

Theoretically, the "Embarkation Hospital" should not be required until sick and wounded begin to be returned from the front, when it should be used solely for invalids, clearing itself as rapidly and completely as possible into hospital ships and sick transports; all cases likely to return to duty being dealt with in general hospitals and convalescent depôts nearer the front.

Unfortunately, the history of all our foreign wars shows that, so far from the General Hospital at the Base remaining empty, and prepared to receive the waste of war from the front, it becomes blocked, on the arrival of the first transports, with men who never ought to have been allowed to leave the shores of England; and, as this will no doubt occur in the future as it has in the past, a separate hospital for these cases at some little distance from the landing-place, if possible on a branch line or rail, or a tram line, would do much to prevent the terrible dislocation caused by

crowding the "Embarkation Hospital" with sick from England, and at any rate could receive the cases of venereal, and what may be termed "accidental," disease which have first manifested themselves on the voyage. It would be largely a venereal hospital, and would not require the elaborate equipment of the other general hospitals.

By this time the lines of communication hospitals will be in working order and ambulance trains can be pushed forward to the points at which their services are most required, carrying up some of the lighter and more urgently needed of the equipment which is now beginning to arrive from home. They can be, to a great extent, staffed by civilians. The advanced General Hospital should now be fully established, its *personnel* being as far as possible made up of Royal Army Medical Corp Officers and men as these arrive from home. A civil consulting surgeon will be attached to this hospital, when one is available. The medical arrangements for defensive war on the frontier are now fairly complete, and, although necessarily of a somewhat rough and ready character, should work satisfactorily for the time being. Fresh troops from England, India, or the Colonies, may be expected to arrive complete, as regards medical *personnel* of field army units, *i.e.*, Regiments, Brigade Divisions of Artillery, Engineer Companies, &c. General Hospitals and Field Ambulances will arrive somewhat irregularly, and more or less complete in equipment and *personnel*, according to the perfection or otherwise of the embarkation arrangements, and the chances of the sea. They must be utilised to the best advantage as they arrive, so that all bodies of troops moving to the front shall go up complete in medical equipment according to regulation; but, as far as may be, chopping and changing, and diversion of medical units from the brigades and divisions to which they were originally attached, should be avoided; and the early provision of base and lines of communication hospitals, and the free employment of civilian aid in them, should greatly facilitate this.

Just at this time it is probable that no great quantity of medical and surgical stores can be placed on the lines to the front, but, a little later, a lull in the forward movement of troops and their impedimenta may be looked for, and should be taken instant advantage of, as it may be of short duration. If possible, the construction of convalescent depôts for officers and men near the front should now be commenced, as their early establishment will greatly relieve the pressure on the advanced hospitals and lines of communication. We may now suppose that the forward move-

ment has commenced ; that the main lines of attack are developing, and that the troops taking part in them are complete in regimental medical *personnel* and Field Ambulance ; that a present sufficiency of general and stationary hospitals is established, and others held in readiness to be moved forward as required ; that the ambulance transport on the line is working, and that hospital ships and vessels capable of being used as sick transports have arrived, and are arriving, at the port. We will now, therefore, examine the equipment of these various units in greater detail, from front to base, before following the fortune of war into the comparatively unknown country beyond, where lines of rail and river may be departed from, and various new contingencies arise.

THE REGIMENTAL MEDICAL OFFICER.

(A) Duties.

The most important, as having the most far-reaching effects, are the sanitary duties. Sanitation must be regimental to be effective, since the failure of a single regiment in this respect may spread disease far and wide. The Indian Army, taught by bitter experience, realises the value of field sanitation, and makes some attempt to carry it out in practice. The Japanese accord it full recognition, and have reaped the reward in a wholly unprecedented freedom from disease, under most trying circumstances. The English Army regards it as a vague unpalatable theory, a rather stupid invention of the doctor, and it suffers accordingly ; witness the comparative losses from (a) preventable diseases, and (b) wounds received in action in every campaign, from the Crimea to the war in South Africa. Indeed, in the Report on the Medical Arrangements of the latter war, one pessimist gravely proposes that, on the approach of the enemy, the force shall retire in order to leave the insanitary state of its late camping-ground to exterminate the foe. This is perhaps expecting *too* much of the average British camp ; but, seriously, our field sanitation is poor, and will remain so until the responsibility is placed where the power lies, and that is with the Commanding Officer. There is no reason why the Commanding Officer should not be as entirely responsible for the health of his men and their sanitary condition on the march and in camp as a cavalry officer is for the state of his stables and the health of his horses. The present system of having a junior officer from another corps to direct him as to what steps he should take in certain matters, with power to practically report him to higher authority

if he neglects to take them, places both in a false position, however tactfully the relations between them may be carried on. A Committee of Officers "Medical Arrangements in the South African War," reports: "No satisfactory system of camp sanitation can be carried out without the intelligent co-operation of company and commanding officers," and adds the recommendation that all officers should be instructed and examined in hygiene. Commanding officers do not, however, "co-operate" with their own subordinates, and should not be asked to do so. Place the whole onus on the Commanding Officer, and he will see that his sanitary staff, headed by his medical officer, do their duty, and that the company officers "co-operate." Each will be in his proper place, relations will be simplified, and the Service at large benefited. There is no need to trouble the combatant officer with examinations in hygiene; he commands the technical services of his medical officer; place the responsibility on him, and he will utilise them. If the day ever comes when commanding officers whose troops suffer from an undue amount of preventable disease are liable to a court martial, on the lines of a naval court martial for loss of a ship, the question of sanitation in the field will be solved.

In order to enable the Regimental Medical Officer to carry on his sanitary duties in a satisfactory manner, he should be provided with one trained assistant, if possible a sergeant or corporal, Nursing Section (passed compounder). At present, while on the march, he is tied to the rear of the column, to pick up and bring on foot-sore or exhausted men, instead of being free to attend to his far more important duty of assisting in the choice of the camping ground, and seeing to the protection and purification of the drinking water, and digging of latrine trenches there. Whenever it is possible—and, except when actually in touch with an enemy, it usually is—water should be sterilised and cooled, or tea made, and temporary trenches dug, before the tired and thirsty men of the main body arrive; for, immediately they reach camp, they will proceed to relieve the wants of nature, and drink whatever they can get, and no amount of belated effort will erase the effect of that first half-hour in an unprepared camp or bivouac. If the whole country is so actively hostile that it would be unsafe to detach pioneers to prepare camp, the regiment should be halted a little short of the proposed position, while an advance party under guard dig temporary trenches and post sentries over the water; and the medical officer should always be up to superintend these operations. An intelligent non-commissioned officer, or even

a private of the Nursing Section, would soon learn to render effectively such aid as can be given on the march to cases of exhaustion, sunstroke and diarrhœa, and thus allow the medical officer to get forward when wanted.

(B) *Equipment: Personal and General.*

(1) *Personal.*—The “pocket case of instruments,” which has to be unpacked like a portmanteau each time it is required, and repacked again, is no use to the much hustled regimental surgeon

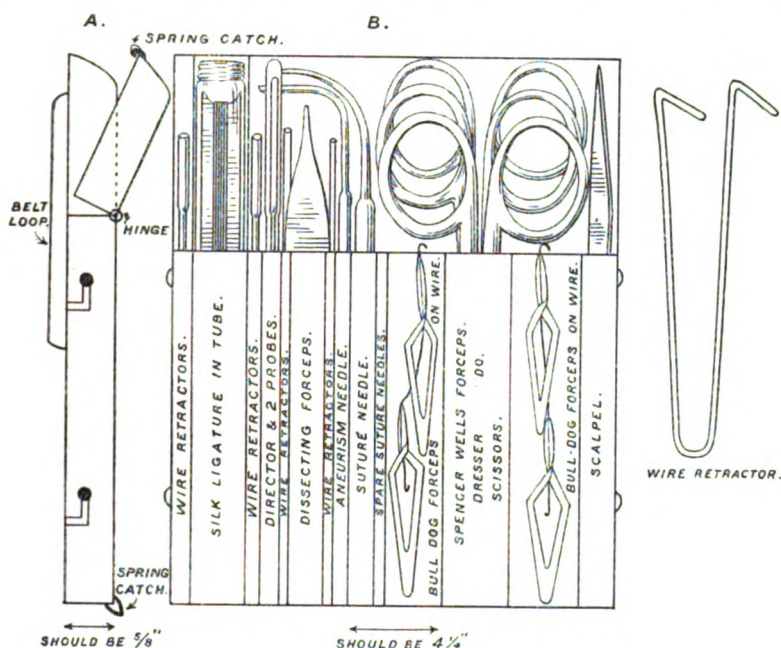


FIG. 1.—BELT INSTRUMENT CASE.

A, side view, showing method of opening, and bayonet-catches by means of which the whole front can be removed for cleaning and sterilisation; B, front, showing roughly position of instruments.

in action. The instruments he requires are few and simple, but should be at hand. A pair of scissors, a stout scalpel, dressing forceps, artery forceps, dissecting forceps, a director, an aneurysm needle and a suture needle with eye in point, a tube of silk ligature and a pair of light wire retractors, carried in a metal case at the belt (fig. 1), and so arranged that each can be drawn out and thrust back separately, will save carrying them into action loose

in the haversack among fragments of food, hunting for them in jungle leaves and grass, or running from place to place with hands full of pocket case and jumbled instruments covered with blood and sand, acts which have come under my personal observation. The hypodermic case (fig. 2) should also be carried at the belt, as in this situation its contents are less liable to drop out when stooping, and are easier to get at. The case should be long enough

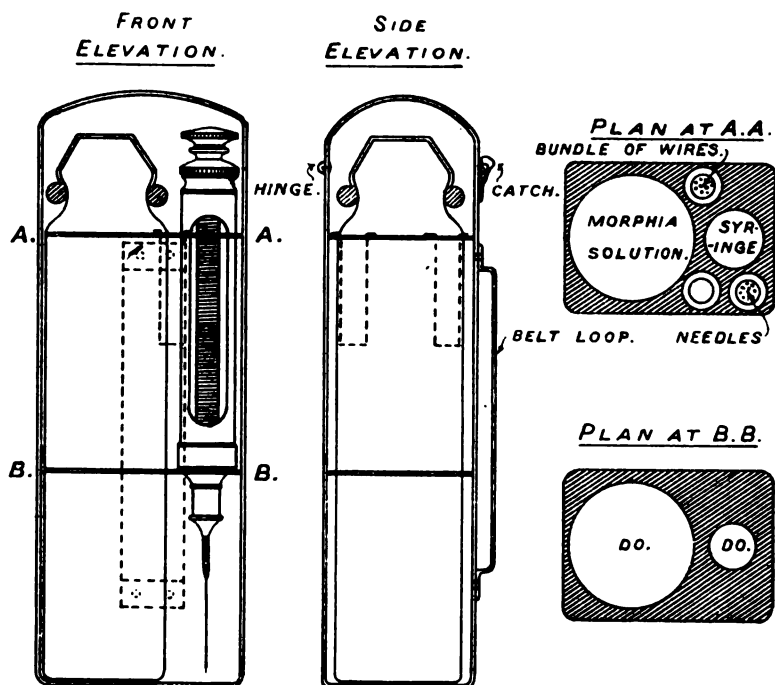


FIG. 2.—HYPODERMIC CASE.

to take the syringe, with needle attached. It should also hold a one-ounce bottle of morphia solution, two spare needles and a bundle of wires. The "tabloids," mortar and measure may well remain with the panniers. The needles should be of large bore, so that the syringe may be filled through them, and should be reinforced at the socket, as in the Parke Davis pattern. The bottle should be covered with a removable rubber cap, through which the needle can be thrust to fill the syringe, thus avoiding all danger of spilling.

The thermometer is better carried separately in the pocket. It should be capable of registering at least 120° F., or it will burst in hot climates, and for that reason should be in a wooden, not in a metal, case. If fitted to a piece of vulcanised rubber tube, enclosed in an outer case of wood, it will stand any amount of heat and jolting without injury.

(2) *General*.—The medical and surgical equipment recommended in Appendix III., "Report on Medical Arrangements in the South African War," appears to be very sound. I would suggest, however, the addition of a good supply of a dusting powder for chafed feet, and a couple of pounds of boro-glyceride; the provision of two good acetylene bicycle lamps with strong *plain* glass fronts, and a supply of carbide of calcium in half-pound tins—these latter only to be used in searching for wounded, or necessary operations.

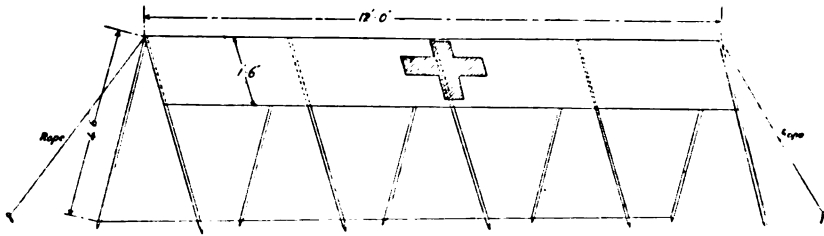


FIG. 3.—SUN SCREEN.

Also, that all utensils should be made of aluminium. The surgical haversack might be slightly enlarged, so as to require less accurate packing, and a flask of brandy be added to its contents. A surgery and detention tent are required. For the former the I.P. Native Officer's single fly, eight feet by eight feet, weight fifty-two pounds, and for the latter the I.P. General Service single fly, eight feet by fourteen feet, weight eighty pounds, would be very generally suitable. I would also suggest that each battalion of infantry, and other arms in proportion, should be supplied with eight light screens of khaki cotton, six feet wide by twelve feet long, as fig. 3. They should not weigh more than six or eight pounds apiece, and could be erected in a few minutes over groups of wounded, so as to shelter at least their heads and bodies from the sun, or to give great protection from cold winds, during those terrible hours of waiting for the Field Ambulance, or death. We have spent many thousands of pounds in elaborating the great General Hospitals

to the point of luxury, and rightly so, but we have done little to alleviate the condition of the dying man on the battle field. It is not brought home to us. The Regimental Medical Officer has done what he could, and pressed on; the Field Ambulance finds a corpse; and the misery of those last hours, unsheltered from the burning sun, or the bitter chill of the night wind, is hardly realised. Even the slight shelter proposed would prove a great boon at such a time.

Each screen should be plainly marked with the designation of the regiment to which it belongs, and have a large red cross sewn on the outside, both back and front. In savage war, where the crosses would only draw fire, the screens would simply be pitched inside out. They would be carried on a light ambulance, to be described presently.

This ambulance would be a permanent part of the Regimental Medical Transport. It would be in charge of the Royal Army Medical Corps, and its *personnel* consist of a non-commissioned officer, a lightweight driver, and one orderly, and in addition to the screens it should carry a supply of brandy, water, extractum carnis, a small paraffin or spirit stove, a pair of paraffin or candle lamps, and one acetylene lamp, and, when such are available, a small stock of cigarettes and tobacco and a few pipes. On going into action the surgeon would use his judgment in distributing a few screens among his bearers. The others would follow with the cart which would work behind him, concentrating on to the central line of advance wounded men whom it was not advisable to move while under heavy fire; the non-commissioned officer in charge arranging shelters, providing the wounded with food and water, and working to and fro along the line till relieved by the arrival of the Field Ambulance, when he would pack each shelter evacuated on his cart, and move forward, eventually rejoining his corps when all had been collected. Such a link between the regiment and the Field Ambulance would, I think, prove a great comfort and assistance to the wounded at a critical time. Besides the actual protection afforded, such shelters would greatly ease their minds as to their eventually being picked up, and would afford little rallying points for those able to walk, after the most pressing need of cover from fire had passed away, and would, to some extent, simplify the work of the Field Ambulance. The non-commissioned officer should be supplied with a syren whistle, the note of which should be entirely different from that of the whistles carried by combatant officers. In the event of a retreat, such a light ambulance would be of great

assistance, as in that case it is the Regimental Medical Officer, and not the Field Ambulance, who does the picking up, and at present he has no efficient equipment for the purpose.

The present stretcher is out of date under existing conditions of fire, since it is ill-adapted for carrying wounded for any considerable distance at a fair pace. Its weight loaded, say 190 lbs., is too much for two men, and four or six bearers per stretcher are wasting their strength at great mechanical disadvantage, and soon tire. A light dhooly could be carried by six practical bearers, such as "Kahars" or Gharwali "jampanies," at the ordinary marching pace of a regiment, for twelve or fourteen miles, with probably the greatest comfort to the patient that anything, short of water transport, could give. Where would a stretcher borne by six bearers be at the end of such a march? A series of competitive trials would soon prove that such a dhooly gives four or six men at least twice the carrying power that a stretcher does. It can be loaded on an ambulance like an ordinary stretcher and takes up less room, leaving more for seating accommodation, and the patient can be protected from sun and rain by simply throwing a blanket over the pole; also it can be carried over steep and broken ground, where it would be dangerous, if not impossible, to carry a stretcher. Six of these dhoolies (two form part of the equipment of the light ambulance and four would be carried) would form at least as efficient an equipment for an infantry battalion as the present eight stretchers. For peace manoeuvres we must have a certain number of our own men taught to carry them, but in actual war neither soldiers of the line nor Royal Army Medical Corps should be used as bearers. They are untrained to carry weights for any distance, and, therefore, quickly become exhausted and inefficient. The man who has been laboriously and expensively trained in time of peace to shoot, should shoot in time of war, and our own men are far too few and costly to be used as beasts of burden, and employed to do badly what a cheaper coolie could do well, while their own proper billets are filled by partially instructed civilians. One bandsman taught to render first aid, should accompany each regimental dhooly, but the bearers should be men enrolled in the country, or preferably Indian "Kahars" especially retained and subject to short annual training.

In addition to the light ambulance mentioned above, one borrowed from the Field Ambulance accompanies the regiment on the march, thus giving two carts to carry exhausted men. Wheeled stretcher trollies are not worth the cost of transport in the fighting line. The conditions of modern war force armies to occupy

positions in mountainous and broken country, where cover can be obtained, and the severest fighting may always be expected on the worst ground.

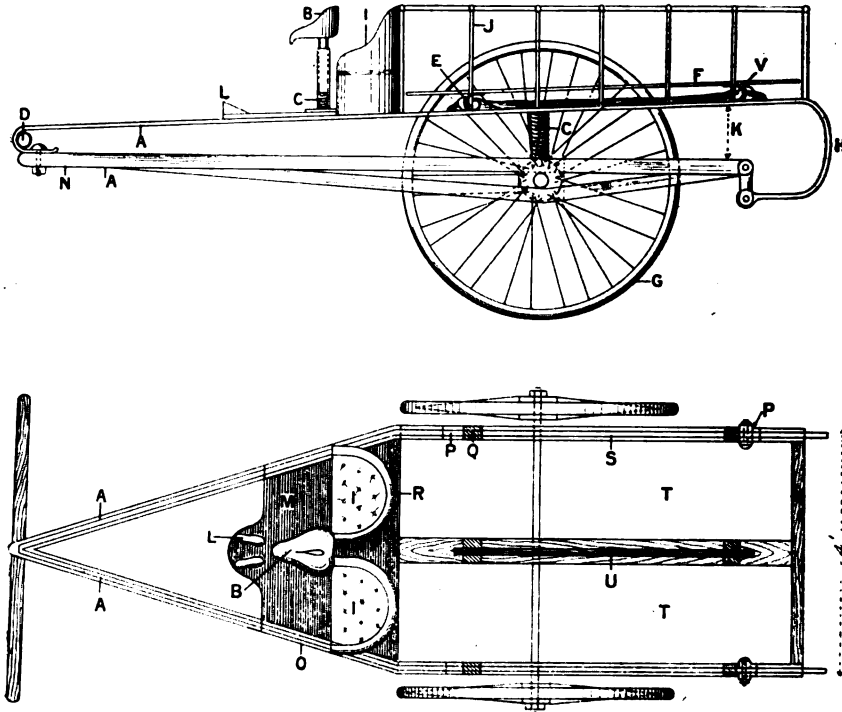


FIG. 4.

A, steel tubes; B, driver's seat; C, springs; D, entrance of tonga bar; E, cross bolts lock the spring legs of the stretcher here; F, stretcher; G, wheel (bicycle pattern); H, spring steel (should have a fuller curve); I, two bucket seats; J, steel tube with open ends, to take hoops of tilt if required; K, this distance should be greater, to bring stretchers level when front pole is well tilted up; L, driver's foot-rest; M, foot-rest for bucket seats; N, should be tilted up more; O, should be slightly curved inwards here; P, stop; Q, stretcher springs slide in grooves of channel steel, and are locked into the stops by cross bolts worked by a lever acting somewhat like that of an "Acme" skate (not shown); R, back of bucket seat; S, channel steel; T, stretcher; U, one-inch partition between stretchers; V, cross bolts lock the spring legs of the stretcher here.

My draughtsman has misunderstood my very rough sketch in several important details, but the above gives a rough general idea of the cart.

For cavalry, the equipment of the medical officer should be considerably modified. It moves fast and travels long distances, often on the flank of an enemy, where connection with the rear by means of an independent bearer company, mounted or otherwise,

is impossible. In savage warfare especially, it is constantly being pushed forward into positions where no unarmed body of men can follow it, and forced to retire from those positions at speed, under a severe and often flanking fire, and under these conditions, it must carry its wounded with it both in advance and retreat, or leave them to certain and probably painful death. On the other hand, its wounded men can be carried on their own horses in many cases; it does not fight with such an extended front as infantry, and it works over better ground. As a general rule where cavalry can be used with advantage, guns can go, and the light two-wheeled cart described under fig. 4, can follow. Wheeled transport over rough ground can never be comfortable, but facts must be faced and comfort sacrificed to speed, if the wounded who cannot sit their horses are to be brought off at all. The cart described (fig. 4) embodies the essential features of the Burmese bullock cart, which, though rough in material and design, can be driven through jungle and forest, over bushes and rocks and steep river banks, where nothing else on wheels could go without capsizing. Indeed, I have often seen a fair horseman prefer to dismount and lead at places down which the Burman would trundle his cart quite unconcernedly. They have no springs, but, with the aid of a little straw, I have even slept in them while travelling on what answer for roads in Burma. In its adapted form it has very easy springs.

Four of these ambulances, each drawn by two mules, driven by one man, and accompanied by two mounted orderlies for loading, would accompany each cavalry regiment into action. Each cart would carry a set of common splints, two thigh splints, bandages and dressings, a small stock of medical comforts, four saddle crutches, and two shelter screens. The mounted orderlies would each carry saddle crutches, and their horses would have breast harness.

The shelters would be used as follows: On retiring under cover of infantry at any point of the field, the wounded (unless they can be handed over direct to a field ambulance) are placed in them, and left in charge of one orderly.

Equipment for mounted infantry, as for cavalry, in proportion.

Artillery, two carts, as for infantry, to each brigade division; (this arm can be well supported by the Field Ambulance and requires no bearers except those attached to the carts, as its wounded fall in more concentrated formation than those of any other arm, and its power of bringing off the slighter cases is considerable).

(To be continued.)

THE SANITATION OF TRANSPORTS.

BY LIEUTENANT-COLONEL H. S. MCGILL.

Royal Army Medical Corps.

THE maintenance of a good state of health amongst British troops outward or homeward bound between England and India or the Colonies, will depend to a considerable extent on the care which is expended in attending to the sanitary requirements of board ship life. A knowledge of the various points to be taken notice of is necessary to all Army medical officers, especially to those detailed to give an opinion on the suitability of a vessel which it is intended to employ in the transport service. The conditions connected with life on a troopship have been considerably improved during the last few years, though there is still room for some improvement. Sanitary defects are most likely to be overlooked at the time when ordinary merchant vessels have to be hurriedly converted into transports for the conveyance of troops over sea. The following are the chief points to which attention must be directed before embarkation, and also during the course of the voyage :—

(1) *Ventilation*.—This is one of the most important sanitary matters connected with board ship life, since on its efficiency will depend the removal from troop quarters of the foul air given off from holds, bilges and damp decks, and the atmospheric impurities derived from the bodies, clothing and lungs of the occupants of a confined space. The natural ventilation of a ship is effected and assisted by the use of windsails, tubular ventilators, ports, air scoops, skylights and hatchways. These answer very well for saloons and cabins on the upper deck. The first two are better adapted for the ventilation of holds and places not intended for human occupation, as they are often defective in action, delivering most air when it is least required—so causing cold draughts and annoyance to the men between decks, who in consequence often tie or plug them up—and frequently admitting water during wet or rough weather. When used for ventilating troop-decks they should be arranged in pairs, one—the inlet—facing the wind and coming to within a foot of the deck below, and the other—the outlet—backed to the wind and ending close to the deck above. Windsails are employed almost entirely as inlets, and one should be introduced through each hatchway. They should be square-

headed, twenty inches to twenty-four inches across, provided with wings to direct the air downwards, and carried well above the awnings when those are spread. Tubular iron ventilators should be furnished to each deck, and their cowls should open at least six feet above the upper deck. Ports are very useful ventilating channels, and some of them should always be kept open in troop decks during smooth weather. Their value can be considerably increased by air scoops which may be kept in without fear of wetting the deck, even when there is a little sea running, if turned two-thirds round in the port with the convexity facing towards the direction of the waves. Skylights and hatchways act both as inlets and outlets for air, but cannot always be kept open. Hollow iron masts and funnel casings are also utilised to remove foul air from below, but they do not effect much in the ventilation of troop decks. It can be taken for granted that natural means, even when aided, cannot ensure efficient ventilation of the main and lower decks, more especially when the weather is rough, sultry or calm, and artificial means must be resorted to, and should be provided, on all classes of troopships. By one method the foul air is extracted with the aid of steam jets which create a vacuum in the upper end of outlet shafts that are connected with perforated air trunks running throughout the ship. This system is noisy, not very efficient, and cannot be used for the supply of fresh air. In another, fresh air is drawn from outside by means of electric fans fitted in the lower end of inlet shafts and propelled along perforated air shafts which run fore and aft through the ship, or, more commonly, is delivered against the bulkhead of the deck, and so gradually distributed to the occupied space. With the latter method the fresh air is not always equally distributed, some parts of the deck being well supplied, while others remain more or less stuffy. The provision of more propulsion fans to each deck—at present there are usually two—or air trunks, would probably remedy this defect. When air ducts are installed the size of the openings from them into quarters should be twice the area of the duct, and they ought to be closed with wire gauze to avoid the causation of draughts. Fans for the extraction of foul air are sometimes supplied as well, and it would be an advantage if there was one on each deck. These extractor fans should work continuously.

(2) *Troop Quarters.*—The troops should only occupy two parts of the ship, viz., the main or gun-deck and the lower or orlop-deck, and if the space is available should be berthed abaft midships. No

bulkheads should be allowed to remain on troop decks except those closing the watertight compartments ; all bulky articles of baggage must be excluded, and the number of birds carried on Indian homeward bound troopers should be strictly limited, since they materially add to the pollution of the atmosphere. The deck should be tightly caulked and sloped outwards towards water-tight channels which should drain into properly trapped and easily cleaned scuppers. The Merchant Shipping Act fixes the minimum amount of accommodation at twelve standard feet of deck and twelve cubic feet of cubic space for each man. This is too small an allowance. No troop-deck should be less than six feet in height, and most are seven to eight feet. Since all troops in quarters are berthed in hammocks, which are allowed a space nine feet long and one and a half feet wide to swing in, it is evident that each man will only receive 13·5 standard feet of deck surface and from eighty-one to one hundred and four cubic feet of cubic space. The lesser dimensions are too small, and the hammocks touch each other when occupied. The minimum should be fixed at fifteen standard feet of deck surface, which, with a height of seven feet, would allow each man one hundred and five cubic feet. Hammocks are to be preferred before cots for troops, as they are more cleanly, and allow a far greater amount of open deck space when stowed. They should be swung two to three feet above the deck. Cells are provided on troopships for prisoners, and are usually placed forward on the main or lower deck. They should be well ventilated, by artificial means if necessary, and allow two hundred cubic feet to each man. The officers, warrant officers, and staff-sergeants are accommodated in cabins on the upper deck, and the amount of deck space *per capita* should be at least fifteen standard feet. Clear deck spaces must also be arranged for the use and exercise of the men, and should not be less than ten superficial feet for each individual.

(3) *Cookhouses*.—The troop galley and bakehouse of transports should be placed on the upper or spar deck on the opposite side to, and as far as possible from, the latrine. In a combined galley and bakehouse, an arrangement which is not to be recommended, as cooking and baking should not be done in the same room, thirty superficial feet of deck space are allowed for the first one hundred men, and half that amount for every other hundred, but when the two places are separate each is allowed twenty superficial feet for the first and ten superficial feet for every additional hundred. These measurements, however, are not strictly adhered to. The height of the troop galleys and bakehouses must be at least six and

a half feet and more if possible. They must be well ventilated and lighted by ports and large skylights, the latter being fixed as far as possible from the vicinity of ovens and range, or their usefulness as fresh air inlets will be greatly diminished. The floor must be paved with tiles set in cement, and should slope slightly towards a side channel opening into a scupper, while the inside of the bulkheads and underneath part of the roof should be lined with sheet iron. The kitchen must be furnished with a range, boilers for soup and meat, a potato steamer, and a zinc covered table, and the bakery with ovens, a kneading machine and tables. Outside should be a room for storing and cooling bread, and a large zinc sink, provided with taps and opening into a shoot, in which to wash utensils. Fresh-water taps should be supplied to both galley and bakehouse. At the end of the day's work all tables, utensils, and the kneading machine must be thoroughly cleaned, and all dry and wet refuse must be removed from the cookhouse as soon as possible. No cooking should be allowed between decks, as it heats the air and loads it with moisture.

(4) *Rations*.—No exception can be taken to the rations now issued to troops on the regular transports. The adoption of cold storage for the preservation of food, and the improved arrangements for preparing it under the supervision of a skilled cook, have enabled fresh meat to be issued five or six days a week, with bread, butter and fresh vegetables every day. This is a great improvement on the old time board ship ration of salt junk, biscuit, compressed vegetables and preserved potatoes, than which no food could be more unpalatable, unattractive, less nutritious or more indigestible. The present scale should be always maintained.

(5) *Drinking Water*.—This is all condensed on board ship, and should be stored in small (six hundred gallon) tanks, painted outside, cement washed within, provided with large manholes, through which, when open, daylight can reach the whole interior, and fixed in easily accessible positions on the deck to allow for proper supervision and cleansing. The daily regulation allowance of fresh water *per capita* is one gallon, which is just sufficient for drinks and cooking. The condensed water should always be cool and fit to drink immediately it leaves the condenser. Fresh-water taps should be fixed at convenient places on the troop-decks.

(6) *Troop Lavatories*.—As personal cleanliness is most necessary in the confined space between decks—especially when in tropical latitudes—it is essential that proper means should be provided for its observance. At present, basins are allowed for only 2·5 per cent.

of the total strength on board, which is quite an inadequate number, and does not permit each man obtaining a proper wash in the morning. The sail seawater bath was probably originally meant to take the place of basins, but many men never use it, and only a few when once cold latitudes have been entered. The sail-bath cannot be looked on as an efficient method of cleansing the body, and though in warmer latitudes its use may prove grateful for a time, still there is no doubt that it is responsible for abdominal catarrhs and for the waking up of latent malarial poison, while in the steamy tropics it conduces to prickly heat. Basins should certainly be provided for 8 per cent. of the troop strength, and they should be supplied with a daily allowance of one and a half gallons of fresh water *per capita*. The deck beneath the washing place should be made impermeable and sloping towards a side channel with scuppers. The trough under the basins is used for washing clothes, and meets all requirements. Warm water should be available for the basins when the weather requires it. Baths are also necessary and should be arranged on the shower or spray system, as reclining baths are wasteful of both time and water. These baths should be provided at the rate of at least 3 per cent. of troop strength, which will allow of every man obtaining a bath twice a week. In some transports there is only one bath for eight hundred or a thousand men, so naturally body cleanliness during the voyage cannot be attended to. The water for the baths may be either salt or fresh—in the latter case two gallons of water will be necessary for each man—and it must be warmed during cold weather. The difficulty of obtaining warm water, fresh or salt, for troop baths on board transports when the weather requires it, is an obstacle to the maintenance of personal cleanliness, for the men, especially those returning home from the tropics, will not bathe when both water and weather are cold. There is no reason why in modern transports warm water, fresh and salt, should not be available for the use of the troops during certain hours of the day.

(7) *Troop Latrines and Urinals*.—These should be placed on the upper and main decks, preferably only on the former, and, when possible, well aft, so that the excreta may rapidly pass the counter. Usually, however, they are placed forward on the opposite side of the vessel to the galley and bakehouse. Latrines must be completely disconnected from all places intended for the accommodation of human beings, should be well ventilated and lighted by outer scuttles and louvres in the doors, and must have an imperme-

able floor sloping outwards. The best pattern is a broad shallow trough supplied with an ample and constant flow of seawater and covered by seats so weighted as to tip up when not in use, and allow of the trough being used as a urinal or for the reception of vomited matters without the risk of soiling the seats. The soil pipe should discharge out of sight well below the deck, and ought to be protected by a storm valve, closing on pressure from outside, to prevent flooding of the latrine. The present scale of accommodation which only allows 2 per cent. of seats is quite inadequate, and at least 5 per cent. of seats should be provided.

(8) *Hospital*.—Every vessel chartered for the conveyance of troops across the sea should have a portion of one deck set apart for the accommodation of sick men when the voyage is longer than seven days. For shorter periods the arrangements do not as a rule require to be elaborate, and one or two cabins, if available, will meet all requirements, or a portion of the main deck can be screened off to form a small hospital. In this a few cots might be slung, three or four being probably sufficient. On longer voyages more complete arrangements will have to be made, which will differ in some details when only healthy troops are carried, and when there are invalids to be provided for as well. Cabins should never be used for the hospital on board troopers, since it is difficult to move helpless patients in and out of them; the necessary medical attendance cannot be properly carried out if serious cases are berthed in such a cramped space; ventilation will not be satisfactory and more nursing orderlies will be required. The troop hospital on a regular transport, and on a freight troopship, should be located on the main deck just abaft midships where there is least noise, least motion, least chance of flooding, and the best facilities for isolation. It ought to occupy the whole width of the deck, should be cut off as much as possible from the main-deck, and should not in any way communicate with the lower troop-deck. The way to the baggage room should not pass through the hospital, as it did on the "Sicilia," for the constant passing up and down of men and kit for hours on baggage days is most disturbing to the patients. On some transports a part of the hospital is placed on the after part of the upper-deck, above the main-deck hospital, which is an excellent arrangement. On vessels employed in carrying only healthy troops, hospital accommodation need not be provided for more than 3 per cent. of the embarked strength. The cots should be six feet three inches long, and two feet wide, 2 per cent. being arranged in double tiers and 1 per cent. in single tiers, since healthy troops should not

ordinarily furnish a larger number of serious cases. The single cots and the lower ones of the double tiers should be of the swinging pattern, and ought to be from one to one and a half feet above the deck, while the space between the cots in double tier, and between the upper cot and the deck above, should be at least three feet to allow the occupants to sit up. Every cot should have the side rails hinged so as to permit of their being turned down when required, and a narrow shelf with an opening to hold a glass, should be fixed at the back of each bed head. A space at least three feet clear should intervene between the sides of adjacent cots, and between the head and foot of those in line, while not less than one and a half feet should intervene between the sides and ends of cots and bulkheads, or the side of the vessel. Since no hospital-deck should be less than eight feet in height, these measurements will give each man in single cots 46·25 superficial feet of deck surface and three hundred and seventy cubic feet of air space, while those in double tiers will receive just half that amount. This should be taken as a general minimum, and on no account should a sick man receive less than twenty superficial feet of deck space and one hundred and fifty cubic feet of air space. The above accommodation is sufficient on transports carrying none but healthy troops, but when invalids have to be embarked a more liberal amount of space should be provided. In this case all the cots should be of the swinging pattern and arranged only in single tiers, while, to avoid confusion, the same amount of space should be given to each; the minimum should be fixed at sixty superficial feet of deck, and four hundred and eighty cubic feet of cubic space, which would be procured by placing the cots at intervals of four feet from each other, and of two feet from the ship's side and bulkheads. When arranged in double tiers the upper cots are not suitable for helpless patients, serious medical or surgical cases, and those suffering from bowel complaints. In all invalid troopers a small ward containing four single-tier cots should be partitioned off from the main ward for the reception of special cases, either officers or men. This should be provided with a separate lavatory, bath and water closet. Amongst troops invalided home there are only a certain number that require cot accommodation. The remainder being more or less convalescent are berthed on the main troop-deck, and according to Indian Marine Regulations, should receive twenty-two superficial feet of deck space *per capita*, which is at least one third more than that allotted for healthy men. This amount is not always allowed nor is it really necessary.

Invalid officers, who are not helpless or seriously ill, are berthed in cabins on the upper deck to which is attached a special lavatory, bath and water closet, but serious cases must be treated in the special ward of the troop hospital. Mess tables should be provided for the detachment Royal Army Medical Corps, and for two-thirds of the cot cases. The messes should be kept separate and allotted a place on the troop-deck just outside the hospital, since it is not advisable for healthy and convalescing men to take their meals in the ward. Besides the usual means of effecting ventilation, all wards during hot weather should be furnished with small electric fans in the proportion of one to every four or five cots. These fans should be capable of being turned in various directions so as to meet the requirements of the patients, and should not be fixed at too great a height above the cots, or their occupants will receive no benefit from the cool air. The hospital should be well lighted by electric lamps, and electric heaters should be provided for use during the winter months in European seas. The hospital lavatory should be partitioned off from the main ward, or, if possible, placed just outside it, and should be provided with basins for 10 per cent. of the sick, and reclining bath for 5 per cent., both being supplied with hot and cold fresh water. It should also be provided with a mirror. Water closets with a flushing rim to the pan, and lift-up seats to allow of their being used as urinals, should be provided for 8 per cent. of the sick. They ought to be placed against the ship side in well lighted and ventilated compartments closed by tight-fitting doors, and not by canvas curtains as at present. The water closets should open into a passage partitioned off from the ward, in which should be placed a covered iron receptacle for soiled clothing containing some disinfectant, and a large sink for the cleansing of utensils. On some transports the basins, baths and water closets are in separate parts of one compartment. On the regular transports a latrine and urinal marked "special" is set apart for the use of those suffering from venereal disease. This is a mistake, since such cases will not advertise their disability by visiting a separate convenience. For them it would be advisable to allot a special compartment in the hospital latrine fitted with a basin, sink and water closet, and supplied with the necessary means for treating their complaint.

The other requirements of a troopship hospital are: (a) Office and dispensary. These are always in one, but should be separate, as the dressing and treating of patients and compounding of

medicine crowds the little room and makes clerical work difficult. An electric fan, good electric lights, and a large office table are all necessary, but all are not given; (b) cupboards in the wards for holding medicine, surgical dressings and stimulants; (c) ice chest; (d) boilers heated by steam or electricity, so that a supply of hot water may be at all times available; (e) drinking water taps without any mug attached; (f) a large cupboard or small pantry in which the table utensils might be kept and the patients' extras, such as jellies, puddings, fruit, bread, butter, &c., could be stored till wanted, and not left exposed in the ward as at present; (g) a small zinc-lined store for soiled clothing; (h) washstands with hot and cold water for the use of medical officers in the ward; (i) store rooms for hospital stores, clothing and equipment, and for patients' kits. These should be located on the lower deck under the hospital; (j) a lift to remove helpless patients to or from the deck and hospital. The lift should be large enough to carry a cot when it is necessary to take a patient on deck for fresh air; (k) a steam disinfecter for infected clothing, which should be placed well aft on the poop. These are all necessary requirements and should be supplied to every regular transport, and to freight troopships when chartered for a long voyage. Insane soldiers are usually berthed on the main-deck forward near the prisoners' cells, so as to be under the control of their attendants. Each patient should have at least five hundred cubic feet of air space and every attention must be paid to the ventilation and lighting of the cubicles, portable electric fans being provided when necessary. When cases of tuberculosis of the lungs have to be conveyed to England in troopships, steps must be taken to segregate them from the other invalids. A portion or, if necessary, the whole width of the main-deck just forward of the boiler casing, which is probably the coolest part of the ship, should be allotted to them, and cut off as much as possible from the other parts of the vessel. The cots must be in single tiers, and at least sixty superficial feet of deck surface, or if possible one hundred, should be allowed to each. The greatest attention must be paid to the ventilation and temperature of the ward, and to the disinfection of sputum, handkerchiefs and soiled clothing. It is always advisable, when practicable, to keep mild cases separate from advanced ones. Spitting on the decks must be strictly forbidden, and sufficient spittoons containing a disinfectant must be provided to prevent this natural tendency in such cases, while each patient should be allowed one or two clean handkerchiefs every day. A separate

messing place, lavatory, and water closets must be provided, and a portion of the upper deck set apart entirely for their use. It may happen that more of these cases are embarked than can be accommodated in cots. This is to be deprecated, since it necessitates hammocks being slung in the ward for the extra men at night, which diminishes the air space *per capita*. Portable electric fans will be required and a weighing machine might be provided. A place in which to isolate a case of infectious disease should be arranged for on every transport, and must be placed well aft on the upper deck, or the poop above it. Three or four cots in single tier will be sufficient, with a separate lavatory and water closet. Large canvas bags should be supplied for the conveyance of infected clothing from the berth to the disinfecter.

(9) *Quarters for Soldiers' Families.*—On Indian and Colonial troopships employed in carrying troops homeward or outward on relief, arrangements have to be made for the accommodation of the soldiers' wives and children. The families of warrant officers and senior non-commissioned officers are berthed in second-class cabins on the after-part of the upper-deck. The berths should not be less than one foot above the deck or six inches from the side of the cabin, and each should be allowed fifteen superficial feet of deck surface. One berth is allotted to an adult with an infant, and to two children under ten years of age. Separate lavatory and water closets are provided. The wives and children of the other married men are given berths on the main-deck just abaft the hospital, and also, sometimes, on the same deck just forward of the engines. The cots are usually arranged in double tiers, those down the centre being in double tiers alongside each other, by no means a sound plan, while the outer tiers are close against the ship's side, which is also objectionable. The berths are six feet long and from two feet to two feet three inches wide, the former being for an adult, and the latter for an adult and infant or two children under ten years. These quarters are generally the most stuffy and crowded ones on board a transport. The centre berths do not get more than twelve superficial feet of deck surface, and ninety cubic feet of air space apiece, and the side ones fifteen superficial feet and one hundred and twenty cubic feet of air space. There is not much difference between this and the space allowed to men, but the vitiation of the atmosphere is probably considerably more than in troop decks, since there are always a number of young children occupying the same berths as their mothers, and the amount of unclean clothing is greater. A space of at least two

and a half feet should intervene between the sides of adjacent berths, and one of one and a half feet between the ends of berths and between the berth and the ship's side. This would allow each berth fifteen superficial feet of deck surface, with one hundred and twenty-three cubic feet of air space, which is quite little enough, and the superficial area might with advantage be increased to eighteen superficial feet for each cot, as is laid down for cabins on the main-deck. This would allow one hundred and forty-four cubic feet of air space *per capita*. The lower berths should be at least one foot above the deck, while the intervals between the two berths and between the upper tier and the deck above should be not less than three feet, to enable the occupants to sit up. A closer arrangement than that suggested does not admit of cleanliness being properly attended to. The gangways at either end of the women's quarters should be at least three feet wide. The strictest attention must always be paid to ventilation, an extractor fan being provided; all bulky boxes and bundles must be excluded, no soiled clothes should be stored under or above the berths, damp clothing must not be dried in the quarters, no infants' food should be prepared in them, and no birds must be kept in them. An adjacent portion of this deck is arranged as a mess room for the married men and their families. Wash basins should be provided for 10 per cent. of the total number, and reclining baths for 4 per cent., both being supplied with hot and cold water, as women and children require warm water even more than the men. Water closets should be provided for 5 per cent. of the strength, with arrangements to suit children; and a large, deep sink is absolutely necessary. Since there are always some women and children that require separate medical treatment during the voyage, a small hospital should be provided for them. Cots for 5 per cent. of strength will be sufficient, and they should be arranged in single tier. One or two portable electric fans and a small cupboard should be fixed in the ward. This hospital is usually bulkheaded off from the after-part of the women's quarters, and must have a separate basin, bath, and water closet. The position allotted is the most convenient one, but a good deal of motion is felt. Should a case suspicious of infectious disease occur amongst the children, isolation must at once be adopted to try and prevent an epidemic, and proper disinfecting measures carried out. Measles, whooping-cough and chicken-pox will be most difficult to keep from spreading to a certain extent, since they are infectious at such a very early stage of the disease.

(10) *General Sanitation.*—The upper deck should be cleaned by wet or dry scrubbing and holy stoning, but should not be flushed with too much water. Wet scrubbing should not be carried out in damp weather, nor when there is less than three degrees difference between the wet and dry bulb thermometers that are kept in the chart-house. Sea water should not be used to clean the troop-decks, and neither dry nor wet scrubbing and holy stoning are suitable, since the first fills the air with dust, and the latter loads it with moisture. Troop-decks, hospital and the women's quarters should be swept, cleaned with hand scrubbers and soap and at once dried. When the weather is too bad to allow of troops going on deck, the berthing parts of the vessel should be sprinkled with hot sand and swept. During cold, damp weather the same may be done, or the deck can be scrubbed with warm water and then rapidly dried. It would be a great advantage, and would facilitate cleaning, if the hospital deck was dressed with paraffin and turpentine. All water channels and scuppers must be flushed and cleansed every day, and, if necessary, sprinkled with a disinfectant. Slop shoots must be fixed on either side of the upper deck and frequently flushed. The bilges must be pumped clean and dry, but should they become offensive they ought to be flushed again and again with sea water, until it returns odourless, and then pumped dry. No fragments of food must be allowed to remain about troop-decks after meals, and any portions of the deck soiled with grease should be at once scrubbed and dried. The table utensils should always be cleaned outside on the upper deck, and the table refuse buckets must be removed as soon as possible and thoroughly cleansed with sea water. Bedding should be aired every day if possible, and all clothing once a week. Soiled clothing must not be stored away on troop-decks, but washed, when necessary, in the troughs under the basins, for which service two gallons of fresh water should be allowed to each man every week. Damp clothing and bedding must not be dried between decks but hung up on lines outside. It would be an advantage if a drying room could be provided in which to dry clothing during wet weather. The men should be warned against sitting in draughts when hot or wet. Overcrowding must be strictly prohibited, the ventilation of troop decks carefully attended to, some ports being always kept open when the weather permits, the openings of the fan inlets must never be closed, and the cleanliness of the persons and clothing of the men should be carefully supervised. Neglect of these last sanitary details, together

with a lavish use of cleaning water, are chiefly responsible for the damp, stale, close smell so often perceptible in troop quarters, and not improbably for the many cases of sore throat and cold to be met with amongst the men. All quarters should be vacated morning and evening in fine weather during the appointed hours and freely ventilated. Healthy troops should pass as much time as possible on deck, and steps should be taken to ensure their getting daily exercise. Spitting on the decks must be strictly prohibited, and vomited matter removed without delay. No person who is only slightly sea sick should be allowed to remain below deck. Attention should be paid to the sufficient supply of water to lavatories, baths and latrines, and the latrine seats must be scrubbed daily. The sick should be allowed on deck as much as possible. Soiled hospital linen should be disinfected, if necessary, before being washed in the troughs under the basins. At the end of the voyage all decks must be scrubbed, all water tanks emptied and cleaned, all hammocks washed, all bedding and blankets brushed, hung in the air for some days and cleaned by steam if thought necessary.

An opinion may be required on the number of troops a freight ship could carry if she had to be employed as a transport for a voyage of more than one week. A fairly accurate solution of this question can be obtained by multiplying the gross tonnage of the vessel by '65 to reduce it to net tonnage, and then allowing two and a half tons net for each man. This scale will include space for three months provisions. If horses are carried each should be allowed seven tons net, so this amount and the hospital accommodation will have to be deducted from the total net tonnage when calculating the number of men the ship can convey.

These remarks are partly the result of observations made during a recent voyage from India in a troopship. It should, however, be remembered that many of the defects noted in this paper have been remedied in the regular transports, though some of them still remain and require to be dealt with.

A NOTE ON TRYPANOSOMIASIS IN SIERRA LEONE.

BY CAPTAIN H. W. GRATTAN.

Royal Army Medical Corps.

TRYPANOSOMIASIS (*Trypanosoma* fever and sleeping sickness) is much more common in Sierra Leone than is generally supposed. From July, 1905, to December, 1905, eighteen cases came under my notice ; I saw many others, but did not have an opportunity of confirming the diagnosis microscopically. Some points in connection with trypanosomiasis in Sierra Leone may be of interest. Lengthy clinical descriptions of a disease, the features of which are now so well known, have been omitted.

Gland palpation and puncture was the method employed in diagnosis. If one depends on examination of the finger blood for diagnosis one must be prepared to devote much time in searching covers or examining centrifugalised preparations. Systematic examination of a couple of covers with a $\frac{1}{6}$ -objective takes at least thirty minutes, and it may be necessary to examine the blood several days or nights in succession before any trypanosomes are seen. Arsenic may have been administered for the fever, the true cause of which was not known, and the search for the trypanosome becomes still more difficult.

From time to time accounts of cases appear in medical journals where the diagnosis was first made by noting the presence of a trypanosome in the blood, and no reference is made to the simple method of diagnosis by gland puncture, discovered by Greig and Gray. At first sight it may appear strange that out of eighteen cases diagnosed by this method, I only saw trypanosomes in the finger blood in two cases on the first examination (two covers only examined). One case, which was examined for six days in succession, with a negative result, showed trypanosomes in the blood taken by liver puncture.

Trypanosoma fever may be divided into two classes :—

(1) Those who do not complain of any symptoms, and are quite ignorant that there is anything wrong with them.

(2) Those who are aware that they are ill and either come to hospital for treatment or consult their native medical men.

Trypanosoma fever may be overlooked, and the fever be attributed to malaria.—It is obvious that cases that present no symptoms will not come under observation, unless special search

is made for them. In Sierra Leone, where malaria is prevalent (endemic index of Magbele Ronietta District, 93 per cent.), it is not unnatural to expect that the latter class of cases of *Trypanosoma* fever may be attributed to malaria.

Sleeping sickness may be overlooked.—One patient (Case 11) came to hospital on account of loss of sexual power. His real trouble was sleeping sickness; the trypanosome was present in his cerebro-spinal fluid. Oedema and nervous symptoms have been attributed to beri-beri. This is more likely to occur when a patient is of the fleshy type. The entry of the trypanosome into the lymph spaces of the nervous system may give rise to attacks of insanity (acute mania, suicidal tendencies, &c.), and may mask the symptoms of sleeping sickness which supervene later (example Cases 10 and 14).

Trypanosomiasis has been contracted in Sierra Leone by natives who have never been out of the Colony or Protectorate. In other words, some of the fly belts must now be considered to be infected.

CASE 1.—Private Momo Yeto (already reported).¹

CASE 2.—November 7th, 1905. Palpated the glands of thirty men, women and children of the village of Wellington, near Freetown. Selected Jabez Newstead, a Creole, aged 11, for gland puncture. Several active trypanosomes seen in the juice from a left cervical gland. J. N. has never been out of Sierra Leone. A sister and brother of his have also enlarged glands.

November 7th, 1905.—Admitted to hospital; treatment with atoxyl commenced.

CASE 3.—Hannah Thorpe, a native of Bonthe, Sherbro. Came to hospital and stated she felt "ill all over."

November 8th, 1905.—A cervical gland the size of a pea punctured. Several active trypanosomes seen. H. T. has lived all her life in either the Colony or Protectorate of Sierra Leone.

CASE 4.—November 17th, 1905. Port Lokkoh. Punctured a cervical gland of "Aboo" (a Timini, aged 28), and found an active trypanosome. He has lived all his life in the Colony. Has had "bumps"² since he was a child. Aboo is hyperæsthetic, nervous and suspicious. Tremors present. He is very thin. It is evident that the trypanosome is in his cerebro-spinal fluid. His brother "Bye" made the following statement: "Bumps, they no good. When the bumps stay long, they kill you; before you die,

¹ JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, Vol. vi., No. 5, p. 526.

² Enlarged glands, also called "nuts."

you go sleep. I done see three men that get bumps in Port Lokkoh; they all die."

CASE 5.—Thomas Coker, aged 22, a native of Bonthe, Sherbro. Has lived all his life in Sierra Leone.

November 11th, 1905.—Gland puncture, right and left femoral, right and left cervical; several active trypanosomes seen in preparations from all four series of glands.



Cases 2 and 5, Jabez Newstead and Thomas Coker.

December 7th, 1905.—Active trypanosomes seen in juice from left axillary glands.

Captain Herrick, R.A.M.C., sent the case to me as one of trypanosomiasis.

CASE 6.—William Andrews, aged 8.

August 23rd, 1905.—Gland puncture ; active trypanosomes seen (Todd). W. A. has lived all his life in Freetown.

Cases of trypanosomiasis are being imported from endemic areas, and cases that have not been in a recognised endemic area for years may develop the disease subsequently.

CASE 7.—Seely, aged 30. Works for Messrs. Paterson Zochonis, Freetown. Came to hospital on August 23rd, 1905, complaining of weakness. Several active trypanosomes seen in juice from left femoral gland. Refused to attend for treatment.

November 24th, 1905.—Is still at work at Messrs. Paterson Zochonis.

CASE 8.—Thomas James, a Krooman, aged 30. Admitted Incurable Asylum, Kiskey, November, 1904, with paraplegia. Has lived at Matadi, in the Congo.

October 24th, 1905.—The paraplegia is due to a transverse lesion of the cord, and has no connection with the *Trypanosoma* infection. Twelve active trypanosomes seen in one cover of cervical gland juice.

November 7th, 1905.—No trypanosomes seen in 10 cc. cerebro-spinal fluid.

CASE 9.—Pablo Lobedo. An advanced case of sleeping sickness from Fernando Po. Admitted to hospital on October 10th, 1905, *in extremis*.

October 17th, 1905.—Gland puncture, left cervical ; eighteen active trypanosomes per cover.

CASE 10.—Momo, aged 40, lives near Magbele. Has been down the Coast.

November 11th, 1905.—Has marked nervous symptoms. Gland puncture, left cervical ; numerous active trypanosomes seen. One active trypanosome seen in examining two covers of finger blood.

November 16th, 1905.—Tried to commit suicide by jumping over hospital verandah. Removed to lunatic asylum.

November 21st, 1905.—Lumbar puncture. Trypanosomes present in cerebro-spinal fluid.

December 15th, 1905.—Is lethargic and has to be roused to take his food.

CASE 11.—James William, aged 30. Came from Fernando Po in 1902. Some glands have been removed from the neck by a native surgeon.

December 14th, 1905.—Several active trypanosomes seen in juice from left cervical glands. *Filaria perstans* present in finger blood.

CASE 12.—“Jimmy,” aged 18. Arrived in Sierra Leone from the Gold Coast in 1902. Is now a servant of Major Hodgins, R.G.A., A.D.C. to His Excellency the Acting Governor.

This case was brought to my notice by my native laboratory assistant, who informed me “Jimmy has bumps.”

November 21st, 1905.—Active trypanosomes seen in juice from cervical glands. States he has no fever and never has had any fever. The temperature, taken on twelve occasions, showed a rise on eleven (98.8° — 100.6° F.).

The Colonial Secretary writes, July 7, 1906: “‘Jimmy’ has developed sleeping sickness.”

CASE 13.—Lemelia Williams, Creole, aged 7. Parents brought her to Sierra Leone from the Congo in June, 1900. The mother states that she has lost a son and daughter from sleeping sickness in Freetown. L. W. has had fever for two years, and has been treated for malaria during the last six months.

December 5th, 1905.—Gland puncture, left cervical; numerous active trypanosomes seen.

CASE 14.—Thomas Williams, aged 40. Admitted Kissey Lunatic Asylum for acute mania. He came from the Congo.

August 23rd, 1905.—Gland puncture. Numerous active trypanosomes seen (Todd); 10 cc. cerebro-spinal fluid withdrawn by lumbar puncture. Trypanosomes present. They were also present in hydrocele fluid. He is comatose, and in the last stage of sleeping sickness.

CASE 15.—Augustus Adams, aged 18; lives in Campbell Street, Freetown.

August 20th, 1905.—Active trypanosomes present in juice from cervical glands (Todd).

Cases 16, 17 and 18, in the West African Regiment, have been reported.¹

Fever was present in all the cases in whom trypanosomes were found in the gland juice, and the pulse rate was raised in all.

After history.—Cases 1, 3, 9 and 14, have died from sleeping sickness.

Cases 4, 8, 10, 11, 12 and 13 have developed sleeping sickness. Case 16 has died from pneumonia, and 17 from colitis.

The possibility of the trypanosome gaining admittance to the central nervous system suddenly, without the disease running the usual course of polyadenitis, &c., must not be lost sight of. In this

¹ JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, Vol. vi., No. 5, p. 524.

way some of the cases of insanity might be accounted for. Lunacy is a common cause of invaliding in the West African Regiment.

REMARKS ON GLAND INCIDENCE UP COUNTRY, SEPTEMBER, 1905.

Place	Number of natives palpated	Number showing typical glandular enlargement	Approximate %	Number with glands palpable	Remarks
Port Lokkoh ..	100	1	1	2	Gland puncture; trypanosomes present; Case 4.
Magbele ..	301	0	0	1	No examination.
Robbari ..	139	3	2	18	" "
Ronietta ..	313	2	75	10	" "
Yonnibana ..	280	0	0	13	Gland puncture 6 cases; negative. Case 1 came from this village.
Moyamba ..	285	0	0	5	No examination.

WHEN TREMOR OF THE TONGUE IS PRESENT THE TRYPANOSOME CAN BE FOUND IN THE CEREBRO-SPINAL FLUID. THERE MAY BE EXCEPTIONS. IT IS ONE OF THE EARLIEST SYMPTOMS, DENOTING THE INVASION OF THE NERVOUS SYSTEM BY THE TRYPANOSOME.

Name	Place	Date	Amount of c.-s. f. with- drawn	No. of cells per cmm. c.-s. f.	Presence or absence of try- panosomes	Presence or absence of tremor of tongue
Pablo Lobedo ..	Colonial Genl. Hosp.	Oct. 21, 1905	10 cc.	..	+	+
Hannah Thorpe ..	" " "	Nov. 8, "	10 "	373 ¹	+	+
Momo ..	" " "	" 21, "	22 "	315	+	+
Momo Yeto ..	Wilberforce Hospital	Sept. 25, "	10 "	..	+	+
James William	Colonial Genl. Hosp.	Dec. 15, "	10 "	226	+	+
Thomas James	Incurable Asylum, Kissey	Nov. 7, "	10 "	..	-	-

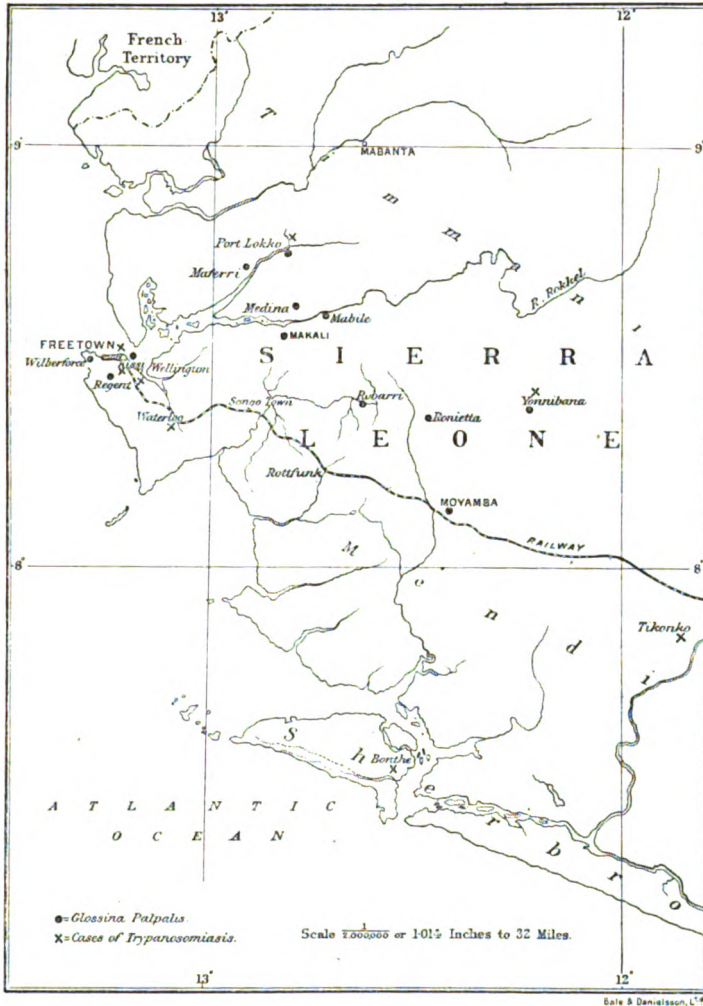
On October 24th, 1905, I examined the cerebro-spinal fluid of "Francis," a case of acute mania. The fluid contained blood; nothing of interest was seen in the deposit. The withdrawal of 25 cc. had little or no effect on the mania.

Glossina palpalis is common in Sierra Leone.—In Austen's "Monograph" of the tsetse flies, 1903, we read that specimens of *G. palpalis* were caught by the author "at the mouth of the Kissey River, near Freetown, August 16th, 1899; at Wilberforce . . . September 10th, 1899, settling on stones in hillside stream, at garrison watering place," page 76. "*G. palpalis* was quite

¹ Grieg and Gray showed there is a progressive rise in the number of lymphocytes in the cerebro-spinal fluid as the disease advances. The following are the averages: 23 per cmm., early stage (polyadenitis); 257 per cmm., first stage (sleeping sickness); 355 per cmm., second stage (sleeping sickness); 730 per cmm., third stage (sleeping sickness). ("Reports of the Sleeping Sickness Commission of the Royal Society," No. vi., p. 25.)

common in the vicinity of Freetown, Sierra Leone, during the months of August and September, 1899."

Mr. Austen also caught the fly near Regent.



Major F. Smith, D.S.O. (in an article in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, Vol. v., p. 692) mentions that "*G. palpalis* is rarely found in barracks . . . and is not often met with on the hill stations for troops as compared with other

places. The tsetse is in great numbers at the lighthouse. At Regent the tsetse is always plentiful. . . . In the hill villages of Gloucester and Leicester . . . the insect is met with along the brooks."

In September, 1905, I forwarded specimens caught at the following places to the Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS. The flies were identified as *G. palpalis* (Austen): (1) Maferri, (2) near Port Lokkoh, (3) Melanki, (4) Robarri, (5) Ronietta, (6) Yonnibana, (7) Moyamba, (8) Makali, (9) Medina, (10) Magbele. Some specimens from Warima and Robarri proved to be *G. fusca* (Austen).

I have seen *G. palpalis* in my verandah at the Hill Station, at the Hill Station Water Supply, and also within one hundred yards of the Asylum at Kiskey. There is a thick belt in the vicinity of Waterloo, and it is almost impossible to walk through the village of Aberdeen, three miles from Wilberforce barracks, without being bitten by this fly.

The natives of Sierra Leone do not as yet look upon the fly as harmful.

General remarks, technique, &c.—The gland juice may contain many trypanosomes and an examination be made with a negative result. The particle of skin punched out by the hypodermic needle may prevent the juice from spreading out between the cover and slide. Failure to see a trypanosome may be due to the gland cells being so tightly packed together that the hæmatozoon is unable to produce any movement of the gland cells, and so escapes the eye. The cover should be examined at once. On one occasion, a cover showed twelve trypanosomes; half an hour later only one could be seen with a phagocyte adherent to it. The trypanosomes may be carried by currents to the edge of the cover and the "best fields" may show nothing. It is useless examining a preparation in which there are many air bubbles.

Trypanosomes were seen in the first cover of gland juice examined in fifteen out of eighteen cases. In two cases they were seen in the second cover, and in the remaining case in the third cover. It is possible to examine cover after cover of finger blood from a case that is known to be one of trypanosomiasis, and yet fail to find any hæmatozoa.

I note that in the latest work on hæmatology,¹ the author states that "the detection of Trypanosomata in the blood is the

¹ Da Costa, "Clinical Hæmatology," second edition, p. 541, 1905.

key to the diagnosis of the disease." When no organisms can be found in the blood a "blood picture" is depended on for diagnosis. No mention is made of the presence of the hæmatozoa in the glands.

Lumbar puncture was performed seven times with cocaine, chloroform being used once only. Thoma Zeiss' apparatus was used for counting the cells in the cerebro-spinal fluid. The fluid is stained with a little gentian violet; no dilution of the cerebro-spinal fluid is necessary; a very low count will result if the cerebro-spinal fluid is not well shaken up before estimating the number of cells per centimetre.

Complications of gland puncture.—No complications occurred in 111 gland punctures. An accident occurred when puncturing a femoral gland: the needle traversed the gland, came through the skin, and entered my finger. The patient under examination was not a case of trypanosomiasis.

In conclusion, I wish to thank the Hon. W. T. Prout, C.M.G., P.M.O., and Drs. Hood, Latchmore, and Renner, Colonial Medical Service, for their kind help in bringing many of these cases to my notice. I also wish to thank the Hon. G. H. Haddon-Smith—then Acting Governor—for kindly providing me with a Court Messenger when travelling up country—a very great help. I have also to thank Dr. J. L. Todd for his kind help and many valuable suggestions, during his short stay in Sierra Leone.

I wish to thank Mr. Austen for having identified many blood-sucking flies and other insects.

THE EPIDEMIOLOGY OF YELLOW FEVER.

By WILLIAM COLBY RUCKER, B.S., M.D.,

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To suppress an epidemic of any disease a correct understanding of its epidemiology is necessary. This demands a knowledge of its causation and transmission. We do not know the cause of yellow fever, but the work of Finlay and the immortal Reed have demonstrated beyond question its transmitting agent. The mosquito dogma reduced to basic principles may now be said to consist of three postulates :—

(1) Yellow fever is transmitted only by the *Stegomyia fasciata*.

(2) To become infected, this mosquito must bite a yellow fever patient in the first three days of his illness.

(3) Twelve to twenty days, usually fourteen, must elapse before a mosquito so infected can transmit the infection.

It was upon these principles that the New Orleans yellow fever campaign was conducted, and the splendid results achieved prove conclusively the truth of this trilogy. Working on this basis the plan of campaign is as follows : (1) Prevent the breeding of *Stegomyia* ; (2) locate all persons sick of yellow fever, or fever which any way resembles yellow fever, as early as possible in the disease ; (3) prevent *Stegomyia* biting them and becoming infected ; (4) destroy all infected *Stegomyia*.

To accomplish the first, an understanding of the life history and habits of the *Stegomyia* is necessary. This insect is essentially a domestic mosquito and shows in every action long association with man. It almost always breeds in and around houses, ovipositing by preference in fresh, clean, quiet water, although, when by force of circumstances its surroundings are changed, it will breed in foul water. Its common breeding places are cisterns, rainwater-barrels, tin cans, broken bottles on the tops of walls, in the space above the chimneys of a barrel, the holy water fonts in the churches, fountains which contain no fish, the sag of a roof gutter, in horse troughs, burial urns, and in the cups formed by the junction of the leaves with the stems of certain trees, such as the pineapple, palmetto, or any of the plants of the *Agave* family. This mosquito is very sly and persistent in its attack, biting by preference just above the shoe tops. As in other species of mosquitoes, it is the female only which bites. The young mosquitoes, which are very voracious, bite in the

daytime, but the adults, the ones which are old enough to be infected and infective, prefer to bite at night or in a darkened room.

First, then, attack this insect in its breeding places. Cisterns are the most important, as they are the most numerous, and on account of the quantity of fresh, clean, quiet water which they contain, form ideal breeding places. They must be screened, preferably with eighteen or twenty mesh bronze wire netting. This is expensive and cheese cloth is usually substituted. The intake and outlet pipes must also be protected. The simplest way is to insert a footless white stocking with an internal spring which expands when released by the inserting hand. This holds the stocking firmly in place, allows the passage of water, but does not permit the ingress or egress of mosquitoes. Cheese cloth cistern covers are apt to be torn by tropical storms. They should, therefore, be frequently inspected and, as a precautionary measure, a coat of kerosene oil, one-eighth of an inch in thickness, spread over the surface of the water. Other breeding places should be emptied, oiled, or filled with sand. To do all this work it is necessary to organise screening and oiling squads, consisting of a foreman and a proper number of men, and supplied with a horse and waggon, ladders, oil, oil cans, cotton cloth, tacks, hammers, &c., for the proper prosecution of their work.

The location of those sick of fevers, and in an epidemic of yellow fever all fevers must be considered suspicious, is not an easy matter. The more ignorant will hide their sick in the fear that they will be sent to the hospital and their places of business closed, while the better classes often act similarly to avoid fumigation of their premises and unpleasant notoriety. The people of the infected city must therefore be kept under constant surveillance. This need not be obtrusive or troublesome to householders, the frequent inspection of the cisterns offering a good excuse for looking over the house. The main support, however, is the family physician. He is required by law to report all suspicious and positive yellow fever cases, and if treated with tact and courtesy he will be of the very greatest aid to the public health officials. If he is derelict in this he is soon found out and punished by law.

Cases must be reported early. The patient is infective to mosquitoes during the first three days only, after which time he is absolutely non-infective, and his discovery is of aid only in that it allows a final fumigation of the house. Inspectors must be reliable and honest. Medical students do very well for this purpose.

Having discovered a positive or suspicious fever case, the patient must be kept in mosquito-proof surroundings. To put it another way, the mosquito must be protected from the patient. An eighteen or twenty mesh bobinet bar must be hung about the patient's bed, the windows carefully screened with fine wire screening or bobinet, and a close-fitting screen door hung. Patients and their friends should be notified that if the screening is cut or torn away, or the door propped open, they will be summarily dealt with. As the patient is very sick at this stage of the disease, this work must be done as noiselessly as possible, lest it annoy and excite him. Nails must be driven with muffled hammers, and gimlets and screws substituted for them whenever feasible. After the room is screened it is inspected by a medical officer, and unusual places through which a mosquito might enter the room, *e.g.*, flue holes, fire-places, and ventilator shafts, are closed. For this work, screening gangs, consisting of a foreman and a proper number of men, are employed. They are supplied with a horse and wagon, ladders, bobinet, screen doors, and such tools and material as they need in their work.

The destruction of all infected mosquitoes must be accomplished by the disinfection of all infected premises, and those adjoining premises to which it might reasonably be expected that mosquitoes would fly. To do this the infected house should have at least two fumigations, a primary when the case is discovered, and a secondary after the case is ended by recovery or death. Contiguous premises require primary fumigation only (contiguous is used in the sense of contiguity from the mosquito view-point, *i.e.*, localities suitable for oviposition). The house to be fumigated should be made smoke-proof by chinking the windows and pasting up the doors, keyholes, flues, fireplaces, ventilators, &c., with paper. It is sometimes necessary when dealing with outbuildings and ramshackly sheds to construct almost a new house of paper. To save time and material it is often wise to cover such buildings with tarpaulins or "Pepperell" sheeting which has been given a thin coat of varnish. Occupants of infected premises may remove anything they wish from the house before fumigation begins, destruction of infected or infectable mosquitoes, *not* of bacteria, being the desired object. After the house has been properly sealed it may be fumigated with any of the various effective culicides. In rooms where there are no fine fabrics or bright metallic surfaces to be injured by the corrosive action of sulphurous acid gas, sulphur, in the proportion of two pounds to the thousand cubic feet of initial

air space, burned in iron pots set in pans of sand, is a most reliable agent. In those rooms where there is bright metal work or fine paintings and draperies which might be injured by sulphurous acid gas, pyrethrum, in the proportion of three pounds to the thousand cubic feet of initial air space, may be used. Another agent which is worthy of a more extended trial is camphor-phenol. This consists of equal parts by weight of pure gum-camphor and carbolic acid in crystals. It is used by vaporising it in such a way that the fumes cannot take fire from the vaporising flame. This is accomplished by using any apparatus which works on the principle of a Davy lamp. It is not to be forgotten that under certain conditions this gas may be explosive, and that it is toxic to human beings as well as mosquitoes. It is used in the proportion of six ounces to the thousand feet of initial air space. Another agent has just been added to the list of culicides by P. A. Surgeon Edward Francis, U.S.P.H. & M.H.S. This is known as pyrofume, and is derived by fractional distillation from pine wood as a by-product in the manufacture of turpentine. It is claimed for it that it is as cheap as sulphur, requires less time for its action, does not injure metals, fabrics, paint or colours, and is non-toxic to man. It is the most promising culicide yet brought forward. If pyrofume is used it is exposed for one hour; all other agents require an exposure of two hours to be effective. The fumigated building is then opened and thoroughly aired. Secondary fumigation should always be done before allowing a funeral or a wake on the infected premises. Fumigation is done by gangs similarly organised to the screening and oiling squads. They are supplied with sulphur, pyrethrum, paste, paste brushes, three-legged iron skillets, tin pans, tarpaulins, &c.

Other than their protection from mosquitoes, the sick are not in any way isolated after the primary fumigation of their premises. They may receive visitors as far as their physical condition will allow, and public funerals are permitted after fumigation of the house. Business in infected towns may go on uninterruptedly, and, with the exception of the closure of places of public congregation at night, there is little interference with life in the infected city. Citizens can aid most by screening their cisterns and ridding their premises of mosquito breeding places. They should not be encouraged to do their own fumigating. It is almost invariably improperly done, and promotes a false sense of security.

Clinical and other Notes.

CLINICAL NOTE ON A CASE OF COMPLETE DEXTROCARDIA.

BY CAPTAIN J. H. P. GRAHAM.

Royal Army Medical Corps (M.).

THERE is at present under the care of the writer, a soldier's son, aged 12 years, whose heart lies completely in the right side of his chest. On inspecting the chest an impulse is seen in the fourth right intercostal space and anterior axillary line, that is, outside the right nipple line; a second area of impulse, less marked but more diffused, is noted about the third right intercostal space and right para-sternal line. Palpation communicates a somewhat heaving impulse at the first named spot, synchronous with the radial pulse and first heart sound; in the second area mentioned the impulse is scarcely appreciable. Percussion gives a roughly quadrilateral area of deep dulness limited towards the left by the sternum from the third to the fifth chondro-sternal junctions; the lower limit lies along the fifth right rib; the outer limit is a vertical line joining the fourth and fifth ribs two fingers' breadth beyond the right nipple line; the upper limit is less well defined, but reaches a curved line drawn from the summit of the outer limit to the third right chondro-sternal junction; the area of superficial dulness is less by about two fingers' breadth. The normal heart sounds are heard over the dull area, most loudly and clearly at the first-named point of impulse; there are no adventitious sounds. The muscles of the right shoulder are wasted, the upper part of the chest in front is flattened, the intercostal spaces are narrow, and expansion is less than on the left side. The percussion note is impaired over the back and front of the upper part of the chest, and auscultation reveals bronchial breathing, bronchophony and crepitant râles over the upper lobe of the lung; the altered breath sound and râles are especially marked in the supra-spinous fossa and in the apex of the axilla. The left side of the chest is larger than the right side, the upper part is more rounded and prominent, the shoulder is higher, the intercostal spaces are wider, expansion is greater, and the percussion note gives greater resonance than on the right side; there is no area of dulness, and the expiratory murmur is audible and prolonged. The patient suffers from cough, hæmoptysis, dyspnœa, sleep sweats and other signs of phthisis, from which he is undoubtedly suffering; it was on account of an attack of hæmoptysis that he first sought advice; neither he nor his parents were aware of the dislocation of the heart, nor does he suffer anything which could be directly attributed to it. The upper

lobe of the right lung and probably the apex of the middle lobe are acutely diseased; the left lung is in a condition of complementary emphysema, and the altered position of the heart is almost certainly consequent on the pulmonary disease.

Abdominal examination, with a view to ascertaining the position of the liver, is not very satisfactory; neither decided liver dulness nor gastric tympany can be obtained in either the right or left hypochondrium; there is undoubtedly a greater sense of resistance on the left side, and the percussion note has less tone; this may possibly be due to unusual descent of the diaphragm. Low down, in the right posterior axillary line, there is a small area of impaired resonance, probably hepatic; it is curious that in a case where it would be expected to find an enlarged liver a difficulty is found in locating that organ satisfactorily by ordinary clinical methods.

Dextrocardia is either congenital or acquired. The former gives rise to no symptoms, and is usually discovered accidentally; it is generally associated with transposition of other viscera, hence the importance of ascertaining the position of the liver; if the liver is found transposed in a case of dextrocardia it is fair to assume that the position of the heart is congenital.

Congenital dextrocardia is not, however, invariably associated with transposition of other viscera, so that it is not safe to conclude that because the liver is in its normal position the dextrocardia is necessarily pathological. In this particular instance, the question is not of great importance, either in connection with diagnosis or prognosis, owing to the very serious pulmonary mischief. But the interest lies in the fact that Babcock appears to regard the congenital form as predisposing to pulmonary tuberculosis; he quotes, in his work on "Diseases of the Heart and Arterial System," the case of a lady who developed phthisis two years after the diagnosis of transposition of the viscera had been made. Acquired dextrocardia is complete or partial; the case under consideration is unusually complete. In "Auscultation and Percussion," Gee says, "And whatever may be the case in dislocations of the heart rapidly produced, there is no doubt that chronic disease can displace the heart so that its very apex beat shall be felt in the right nipple line." Further on he adds that in displaced hearts the impulse seen to the right of the natural position is often some part of the ventricle other than the apex. There is a considerable difference of opinion with regard to the anatomy of the condition. According to some the heart being fixed at its base is, in process of transposition, rotated on its long axis, so that more either of the right or left ventricle than is natural comes to the front; simultaneously, the apex is said to be swung across the front of the chest to a variable extent, the heart even assuming a horizontal position in extreme cases. Others maintain that the heart is neither rotated nor the apex swung over, but that the heart is moved bodily over with the mediastinum,

retaining approximately its normal relation to the diaphragm, and that the impulse found to the right is that of the right auricle, the apex lying behind the sternum. Clinical and *post-mortem* evidence is adduced in support of both contentions; there is, unfortunately, nothing in the present case to indicate the anatomical condition with certainty. There is general agreement as to the causes of displacement to the right in acquired cases. The causes given include increased pressure in the left pleural cavity, owing to the presence of fluid or air, and tumours to the left of the heart; phthisis, cirrhosis, and old pleurisy of the right lung can also cause the displacement, owing in part to contraction of pleuro-pericardial adhesions. With removal of the cause of increased intrapleural pressure, the heart may return to its normal position, but traction by pleuro-pericardial adhesions causes permanent and the most extreme degrees of displacement.

NOTES ON A CASE OF ACUTE YELLOW ATROPHY OF THE
LIVER, WITH REMARKS ON THE ETIOLOGY AND TREAT-
MENT OF THE DISEASE.

By MAJOR C. B. LAWSON.
Royal Army Medical Corps.

Patient.—Driver A. R., R.F.A. Was admitted on February 9th, 1903, apparently suffering from a mild attack of catarrhal jaundice. On February 18th, 1903, he developed mental symptoms, and was transferred to a special ward. He came under my charge on February 25th, 1903. He was slightly jaundiced, his skin being lemon-colour and conjunctivæ faintly yellow. Urine slightly bilious; it did not give a very typical "play of colours" with Gmelin's test. No albuminuria. A few gonococci.

Alimentary System.—Tongue slightly furred, yellowish-white; teeth good; no aural sepsis. Liver and spleen tender, but not enlarged. Stools white and scybalous.

Circulatory and Respiratory Systems.—Normal.

Nervous System.—He looks dull, half asleep, in fact, in a state of mental torpor, but he can be roused into sufficient intelligence to answer questions relating to his case. Pupils regular, react both to light and accommodation; no nystagmus; superficial and deep reflexes normal. Organic reflexes, incontinence of urine and fæces at times.

Blood Examination.—Showed a polynuclear leucocytosis. No malarial parasites.

Temperature.—102° F. on admission, then normal until three days before death, when it rose to 103° F.

Pulse.—Slow, 56, regular, low tension; the same on both sides; artery not thickened.

He has had syphilis and gonorrhœa. There is a history of intemperance.

March 4th, 1903.—He has become slightly delirious. Has vomited curdled milk and passed some unaltered blood in his stools and urine.

March 8th, 1903.—More vomiting of undigested milk and also some bile, followed by a good deal of collapse.

March 9th, 1903.—Vomiting continues and consists of food, mucus, and bile.

March 12th, 1903.—No vomiting now. About 6.30 p.m. his temperature was 103° F., and he was tepid-sponged, but with little beneficial result. He was seen by Lieutenant-Colonel Whitehead, R.A.M.C., who suggested acute yellow atrophy of the liver as a diagnosis. The liver dulness was four inches in the mammary line. Leucin but no tyrosin in his urine.

March 13th, 1903.—Liver dulness rapidly decreasing; only half an inch in mammary line this morning. Both hepatic and splenic regions are tender. Temperature, 103.6° F. He had a convulsive seizure at 8 a.m., and became semi-comatose. Pulse rate has risen from 52 to 124. He was tepid-sponged. Evening temperature, normal; pulse, however, still rapid, but regular and of low tension. Case diagnosed acute yellow atrophy of liver.

March 14th, 1903.—No liver dulness anteriorly and three inches in mid-axillary line. Leucin and gonococci still in his urine; also some blood. Vomiting of mucus and bile still continues. At 6 p.m. his temperature rose to 101° F., coma deepened, pulse became almost uncountable, and he died at 9.30 p.m.

Treatment.—Purely symptomatic; careful feeding and nursing.

Post-mortem Examination.—Thirty-six hours after death. Body fairly nourished. Skin, bile-stained a greenish-yellow. *Rigor-mortis* present in trunk and extremities, but passing off from neck. *Post-mortem* lividity marked on posterior aspect of body. *Abdomen*—Liver weighed 2 lbs. 7 ozs., flattened, capsule wrinkled, and surface presents purplish and yellowish-brown, almost circular areas, about two inches in diameter, which were very friable; the organ also shows fatty degeneration; it feels tough to the knife. Similar coloured areas and fatty changes found on section. Gall-bladder shrunken and almost empty; contents liquid bile. Spleen, 11 ozs., congested and easily friable. Kidneys, normal. Pancreas, bile stained. Large and small intestines normal.

Thorax.—Right lung, 1 lb. 13 ozs., showed patches of congestion. Left lung, 1 lb. 9 ozs., was in a similar condition. Heart, 12 ozs., valves, substance, and great vessels normal.

Head.—Superficial cerebral and cerebellar vessels engorged; puncta cruenta well marked.

Microscopical examination of the liver.—Capsule thickened; cells of parenchyma atrophied; purplish and yellowish areas consisted of masses

of pigment, and granular and fatty *débris*. Leucin was also found in some of the sections, but no tyrosin. Bile ducts empty. Atrophic changes most marked in purplish areas.

Special points.—Impossibility of diagnosis in the early stage from a case of simple catarrhal jaundice. Almost afebrile course. The sudden and marked alteration in the pulse rate, slow at first as in ordinary jaundice, then greatly increased as the disease approached its fatal termination. The long duration of the case. Polynuclear leucocytoses. Leucin being found without tyrosin.

General remarks on the disease.—The hæmorrhages and splenic enlargement point to its being of the nature of an infectious disease or a toxæmia; so far, however, no specific micro-organism has been reported.

As regards its etiology, it may possibly be due to some toxic action on the liver cells, the resisting power of which has been lowered by syphilis and alcoholism, conditions nearly always associated with the disease.

Treatment.—Hitherto this has been purely symptomatic, but judging from the beneficial results that the intravenous and subcutaneous injections of saline fluid have produced in the toxæmic condition of yellow fever and post-operative (especially abdominal) acute yellow atrophy of liver, they should be tried in this very fatal disease.

Perhaps an antitoxin will be some day forthcoming.

NOTES, MAINLY *POST-MORTEM*, ON A CASE OF ANTHRAX IN A SOLDIER.

BY CAPTAIN L. W. HARRISON.

Royal Army Medical Corps.

PRIVATE C., aged 28, 3rd Hussars, reported "sick" at the Station Hospital, Sialkot, at 6 p.m., on July 17, 1905, complaining of "fever," with headache and vomiting, of three days' duration. He was seen by Major R. N. Buist, R.A.M.C. His temperature was 103·6° F., but no other objective signs of disease were visible. A sample of blood for microscopical examination was taken from the finger, which was found to contain nothing of diagnostic importance. During the night the temperature dropped to 102° F.; he complained very much of pain in the head, but was never delirious. He could not tolerate the ice-bag to his head, and vomited everything given, including water. At 5.30 a.m. on the following day he was given some water by the orderly, and spoke quite sensibly. At 5.45 a.m. he died.

Post-mortem examination four hours after death.—*Post-mortem* rigidity and hypostatic congestion well marked. The blood was fluid in all the veins. *Pericardial sac* contained a little clear fluid. *Heart* weighed thirteen and a half ounces; no sign of valvular disease. *Lungs*, right, nineteen ounces; left, seventeen ounces, congested. *Spleen* weighed

fourteen ounces, and was very congested and friable. *Kidneys*, right, eight ounces; left, seven ounces; both congested. *Liver* weighed sixty-seven ounces, and was very congested. *Stomach*, mucous membrane very injected. *Intestines*, mucous membrane very injected. Ten inches from the ileo-cæcal valve was an ulcer, half an inch in diameter, the floor of which was white, and it was raised slightly above the surrounding mucous membrane. No other ulcer was seen, nor were Peyer's patches or solitary follicles enlarged. *Brain* weighed fifty-seven ounces. The cerebral capillaries were intensely congested, and the dura mater adherent to the pia-arachnoid in two places over the occipital lobes.

Smears of blood from brain, spleen and liver, were seen on staining and microscopical examination to be crowded with stout, square-ended bacilli, many (spleen smear) containing spores, and indistinguishable from anthrax bacilli.

Owing to apparatus not being at hand when the necropsy was performed I made no culture then, but after examination of the smears I reopened the body, and took cultures in broth and on agar from the spleen, after searing the surface in the usual manner. Twenty-four hours later the agar stab showed a very small white point, which was a pure culture of a bacilli similar to that seen in the smears, but joined end to end more in chains. These bacilli were quite non-motile in hanging drop. In the broth cultures a small motile bacillus grew, which, as I was going on leave, I had not time to investigate. I carried the agar stab cultures to Murree, and there made sub-cultures in broth and gelatine stab, which grew in the manner characteristic of anthrax.

The *post-mortem* appearances of the organs, and the results of the microscopic and cultural examinations, leave little doubt that this was a case of anthrax, and that the initial lesion was very probably the ulcer in the ileum noted above.

The case is interesting, I think, as illustrating the importance of a microscopical examination in cases of rapid death, where no definite signs of any particular disease were apparent during life. Without a microscopic examination the diagnosis in this case would have been impossible, and the vigorous disinfection which took place as a result of the diagnosis being established would never have been undertaken. Knowing the persistence with which anthrax infection lasts, the fact that the deceased was sick for three days in his barrack room, and that the hospital mortuary was naturally badly infected from the *post-mortem*, the results of such an omission may be safely left to the imagination.

I would add that rubber gloves should be worn when making necropsies in India, particularly during the hot weather, when one's hands are never free from scratches, as a result of the irritation of sand-fly and mosquito bites. The use of rubber gloves on this occasion would have relieved my mind, and the minds of those who assisted at the necropsy, of a certain amount of reasonable anxiety, and would have saved me from the

annoyance of a carbuncle on my wrist, which developed as a result of the liberal use of pure carbolic to a scratch there.

Regarding the cause of infection in this case, nothing definite can be said. The man was not employed with horses, being on police duty, and the only clue which has been obtained is that, a few days before he was taken ill, in the performance of his duty, he had to examine the loads of some natives passing through the lines carrying hides. Anthrax is fairly prevalent amongst animals in the neighbourhood.

THE LOCAL TREATMENT OF GONORRHOEA.

By J. S. PURDY, M.D., C.M.(ABERD.), D.P.H.(CAMB.).

Egyptian Quarantine Service, Port Said. Surgeon-Captain, New Zealand Militia.

In order to prove the statement that urethral hand injections reach the membranous urethra, and also the height at which to hold the douche tin in urethral and intravesical irrigations, the following experiments were made on cadavers. With an ordinary four-drachm glass syringe a urethra was injected with a strong solution of methylene blue. On slitting up the urethra on a director the mucous surface up to and including the membranous urethra, no further, was stained. One was astonished to find that an elevation of three feet was sufficient to place the douche tin in order to secure intravesical irrigation, methylene blue being found in the bladder. With an elevation of two and a half feet the prostate was stained with methylene blue. It does not follow that the same results are obtained on the living, yet the results of these experiments have confirmed me in my opinion, based on experience in treatment, that it is impossible to effect a complete cure of posterior gonorrhœal urethritis, gleet, or prostatitis merely by using hand-injections. This does not apply to simple anterior gonorrhœal urethritis. Experience gleaned at the London Lock Hospital, whilst testing the effects of different injections, showed that with a solution of 5 per cent. argyrol one was able to stop all obvious discharge within four to ten days.

In a series of sixty-four cases, as reported in the *Lancet*, December 19th, 1903, and the *Scottish Medical and Surgical Journal*, May, 1904, results were obtained from the point of rapidity of cure much in excess of other methods. Following up the cessation of the discharge by the use of an astringent such as sulphate of zinc, one grain to the ounce, in some cases a cure was effected within fourteen days. A point of great importance was the necessity of giving the patient printed or written instructions as to when and how to inject. The average individual consulting a medical man for a first attack of gonorrhœa is, as a rule, too flurried to remember in detail any instructions. More often still he falls

into the hands of a chemist, or worse still a charlatan either oblivious of the importance of such details or still in a stage of creditable ignorance.

Experience in private work has since taught me that to get the full gonococcal effect of argyrol it is necessary to use it warm and to hold it in the urethra for ten minutes. Afterwards, when using astringent injections, always necessary to complete a cure, half a minute is quite sufficient.

It is only fair to mention that equally good results in anterior gonorrhœal urethritis were obtained at the Lock Hospital by irrigation. However, in treating a simple case of anterior gonorrhœal urethritis it is not necessary to resort to irrigation, although patients appreciate its benefits and express themselves as much relieved even after the first warm irrigation.

One of the most successful cases from the point of view of rapidity of treatment, is that of a youth who recently consulted me with a gonorrhœal discharge six days after connection. I irrigated him twice with a pint of warm saturated solution of boracic acid. He injected himself thrice daily with a 10 per cent. solution of argyrol, holding it in the urethra about eight minutes. After the second irrigation, on the fourth day, there was no discharge. He then used the argyrol only once a day for two days and an injection of sulphate of zinc twice a day. After the eighth day there were no "floaters" in the urine. He ceased treatment, and within three weeks was able to drink a bottle of laager beer without any ill effects.

It is quite another affair, however, to tackle the treatment of posterior urethritis. To treat this disease locally, hand injections are not sufficient. Although I have seen excellent results follow the use of deep instillations of silver nitrate applied by a Geuyon's syringe, yet I know nothing better than intravesical irrigation for the treatment of chronic posterior urethritis. This can be done by means of a soft india-rubber catheter and a douche tin. The method usually known by the name of Janet's is, however, by far the easiest and most efficient. My first cases were treated with an apparatus consisting simply of a douche tin, an india-rubber tube, a burette clip, and a glass bulbous nozzle. One found, however, that this simple apparatus had many limitations, and supplemented it later with the more elaborate apparatus of Chetwood and Valentine.

Recently I have found that by using a special double channel celluloid nozzle, either shaped like a Y with the bottom leg divided into two by a central diaphragm, or, better still, with a central inner tube, it was quite easy to practise urethral irrigations. Messrs. Reynolds and Branson, Leeds, supply such a nozzle, attachable to an ordinary douche tin and tube. An ordinary large burette clip, whilst infinitely simpler, is quite as useful as the more elaborate scissor clips used by American urogenitary surgeons.

In examining a patient I follow the method taught by Mr. Charles

Gibbs, namely, urination into a series of three or more glasses. Roughly, the first contains the washings of the whole urethra; the second, if cloudy with pus, indicates either posterior urethritis or cystitis; whilst if the third glass is quite clear may infer that the bladder is not infected. To prove that the posterior urethra is infected, if there is any doubt about it, one can irrigate the anterior urethra with a warm solution of boracic acid, and then ask the patient to micturate. Should the first flow contain pus after this, then the infection has spread to the posterior urethra. By getting the patient to use a weak injection of permanganate of zinc, protargol, argyrol, or other coloured injection, two or three hours before presenting himself, one learns that the anterior urethra is affected by the passing of brown shreds into the first glass. When the deeper part of the urethra is infected, one gets tadpole-like shreds in addition to the urethral dust, and white cotton-like threads seen in anterior urethritis. Prostatitis as a rule is indicated by the presence of floating, fleecy, cottony shreds. A bacteriological examination, if negative, gives little information. In two cases examined in one day at the Lock Hospital, an organism like the Klebs-Löffler bacillus was found. In some specimens examined by the class at the Royal Army Medical School in June, 1903, procured by me from cases attending the out-patient's department at the Lock Hospital, some involuted forms of the gonococcus were found. Speaking generally, gleet is shown really to be a mixed infection. It is advisable to prescribe urotropine or betroline for a week or two after all flocculi have disappeared. At the Lock Hospital, one came across some cases which responded to no treatment either local or medicinal. These were few in number and generally found in chronic *habitues* of the hospital. After using a urethroscope and touching patches with silver nitrate, in some cases one saw good results; but in my hands, even after a year's experience with myriads of out-patients, was not a great success, except to make an impression on neurotic patients, a result as well obtained by using a cold sound.

In the treatment of gonorrhœal rheumatism no drug tried had much effect. Perhaps most relief, after destroying the source of infection, was obtained by hot baths and the application of guaiacol ointment.

It is my practice now to treat an ordinary case of gonorrhœa, when seen within the first few days after the appearance of the discharge, with injections four times daily of a 10 per cent. solution of argyrol held in the urethra for ten minutes, if possible. After the discharge ceases an injection of sulphate of zinc, one grain to the ounce, three times a day for at least a week. Medicinally, I give sandal wood oil or copaiba, and finish with urotropine or betroline. A chronic case I always irrigate with a warm solution of boracic acid every third day, making the patient use hand injections of argyrol in the intervals, followed later by half-minute injections of sulphate of zinc. When a case does not quickly respond to this method, sometimes it may be worth while to try iodoform bougies.

But, as a rule, when the sticky stage of the "morning drop" does not disappear under irrigations, it is best to give tonics.

Like others, I have known some few chronic cases which claimed to have been completely cured after a debauch following an abstinence of months.

With regard to irrigation, a late colleague of mine, Dr. Plasz, told me that this method was practised in Hungary many years before the procedure generally known as that of Janet's was described.

At the first attempt at intravesical irrigation it is difficult to overcome the constrictor urethræ in a nervous patient unless the douche tin is held sometimes as high as six feet. However, this pressure of water is too great, and if one cannot overcome the constrictor with an elevation of four and a half feet it is generally advisable to use a catheter. But, as a rule, once the patient has experienced the benefit and comfort of anterior irrigation it is quite easy to irrigate him intravesically. Orderlies with some aptitude can easily be trained to use the irrigation apparatus. The best craftsman at the Lock Hospital in my time was an ex-private of the Royal Army Medical Corps.

Although well aware that it is only with the younger generation of urogenitary surgeons in England that the bugbear of "driving back the gonococci" has lost its terrors, I have never seen any complications which are alleged against this method of treating gonorrhœa.

A CASE OF RECURRENT DISLOCATION OF THE LEFT HUMERUS.

BY CAPTAIN E. W. BLISS.
Royal Army Medical Corps.

E. D., a private in the 1st Royal Fusiliers, was admitted to the Portsmouth Military Hospital with a view to having some operation performed for the relief of the above condition. His statement was that the shoulder was first put out three years before, and since that time it has been repeatedly dislocated; latterly, a very slight cause has been sufficient to produce the condition. He thought that in all the shoulder must have been out about fifty times. The patient had gone in a good deal for boxing, and this had on several occasions been the cause of the dislocation. On examination he was found to be a well-built powerful man of exceptionally good muscular development. No difference could be noted in the appearance of the two shoulders, and from his description the dislocation appears to have always been of the sub-coracoid variety. There seems to be unusually free movement in the affected shoulder joint. As the disability was causing him a great deal of inconvenience and pain at times, and he was extremely anxious to have something done, I

decided to operate with a view to closing a rent in the capsule, if such should be found, or, failing that, tightening up the capsule if it should prove to be abnormally loose.

On May 31st, under chloroform, I made an incision about six inches long commencing just below the coracoid process and passing downwards in the interval between the pectoralis major and deltoid muscles. The cephalic vein came into view at once and was cleared and drawn outwards with the deltoid, and the upper third of the fibres of the pectoralis major were divided to give more room. The coraco-brachialis and biceps were next defined, cleared and drawn inwards. The fibres of the sub-scapularis muscle were then seen, and some of them divided and separated from the capsule. A careful search was then made for any rent in the capsule, the humerus being meanwhile moved in various directions. No tear in the capsule could be found anywhere, but it appeared to be extremely lax, allowing of abnormally free movement of the head of the humerus. I therefore decided to endeavour to tighten it up by means of including an illiptical portion in sutures.

In the only literature on the subject to which I had had access I could only find two cases recorded that had been operated upon, and in each of these the joint had been opened and an illiptical portion of the capsule having been caught up with forceps was removed, the opening being afterwards sutured up. I did not see why as good a result should not be obtained without opening the joint; I therefore took up with vulsellum forceps a portion of the inner and anterior portion of the capsule, and with a mounted needle threaded with No. 4 plaited silk passed four sutures through, the two centre ones being much the deeper. On tying these up it was found that a considerable difference had been made in the laxity of the capsule, but not to such an extent as to in any way interfere with the mobility of the joint. All hæmorrhage having been stopped, the divided fibres of the pectoralis major were sutured with catgut, and the pectoralis and deltoid muscles were allowed to fall back into their normal positions. The skin incision was closed with silk-worm gut; no drainage was used.

After treatment.—The patient was kept in bed for five days with the arm bandaged to the side. The wound was dressed and sutures removed on the ninth day, and passive movements were commenced. At the present time the patient has perfect movement in the joint, but has been warned against making any excessive movements likely to reproduce the disability.



To illustrate paper by Captain H. J. McGRIGOR, R.A.M.C.,
"A Case of Erythema Multiform of the Iris Type."

CASE OF ERYTHEMA MULTIFORM OF THE IRIS TYPE.

BY CAPTAIN H. J. McGRIGOR.

Royal Army Medical Corps.

A SOLDIER, aged 22, was sent into hospital diagnosed "syphilis." He had a peculiar eruption on his hands and ears and a diffused ulceration extending over almost the whole of the buccal mucous membrane of the lower lip. There was no history or appearance of previous syphilis.

The history of the case is that for the past nine years he has had annual attacks similar to the present one. These attacks usually occur in the late spring or early summer, although some have occurred in October and December. One year the patient had three separate attacks. No special article of diet appears to have etiological importance. No constitutional disturbance. The lesions appear first on the hands and ears as small red patches about the size of a lentil; these become blisters, which itch, but are not painful or tender. The number of the lesions varies, but is usually about fifteen or twenty. They appear simultaneously on both hands and they never appear higher than the wrists. These blisters tend to sink in the middle, and then outside the depression arises another blister of a ring shape, raising a sort of rampart around the original blister. Some of the lesions go on in this way, finally furnishing regular "bull's-eye" patterns, and may extend up to the size of a two-shilling piece, but never to a greater size. These rings do not occur in any particular regions of nerve supply, but are noticeable features in that they are nearly all on the extensor aspects. The left hand has in all twenty lesions, only two of which are on the palmar aspect; the right hand has twenty-eight lesions, three of which are palmar.

The accompanying photograph shows very well the various stages of the disease from the original papule seen on the phalanges to the large patch on the back of the hand.

The lesions start desquamating in the centre, and ultimately all the raised reddened epidermis comes off, leaving a pink smooth surface of fresh epithelium. The lesions on the ears are at the edges and are similar in appearance to those on the hands. The lesions of the mucous membrane always occur on the inside of the lower lip, which becomes white and sodden, and has an appearance undistinguishable from syphilitic mucous patches of the snail-track type. Faint traces of rings can be seen in the regenerating mucous membrane.

From start to finish these attacks last about one month and usually disappear without any treatment. This attack has not been accompanied by any constitutional disturbance, but the patient informs me that on two occasions when the eruption appeared he suffered from very severe attacks of "asthmatic bronchitis." There is the suggestion in this that the mucous membrane of the bronchi probably was in a similar erythematous

condition to that of the mouth. There is no history of intestinal disturbance in any of the attacks.

The treatment adopted was to put the patient on 15 grains of sod. salicyl thrice daily, to coat the lip with glycerine of borax and keep the mouth clean with a mouth wash of 1 in 2,000 perchloride of mercury. The hand lesions were protected with cotton wool.

The interest of the case lies in the very close resemblance which the mouth lesions have to that of secondary syphilitic patches, the patient being sent to hospital diagnosed "syphilis," but here the history and course of the disease and the striking eruptions on the hands cleared up all doubt as to the nature of the malady.

The excellent photograph of this case was taken by Private Jones, of 20th Company, R A.M.C., Bulford Camp.

NOTES ON SIX CONSECUTIVE CASES OF DYSENTERY TREATED BY ANTI-DYSENTERIC SERUM.

BY LIEUTENANT S. E. LEWIS.
Royal Army Medical Corps.

CASE 1.—Gunner S., admitted on February 28th, about 11 a.m., complaining of diarrhoea with intense pain during the motion, but he had not noticed whether he had been passing blood. Since 4 p.m. yesterday he states that he has had about thirty stools. Temperature 99.2° F. Pulse 96, weak. On examination, patient lies curled up and looks very ill. Tongue coated, breath foul. Some pain on pressure over the lower portion of the abdomen. Heart's sounds quick and feeble. Nothing else abnormal detected. Treatment: Put on a plain milk diet with three bottles of soda and brandy, 3 iv. At 6 p.m.: Has had fourteen stools, small, and consisting of blood and mucus; complains greatly of tenesmus. Treatment: The abdomen having been sterilised, 20 cc. anti-dysenteric serum were injected into the subcutaneous tissue of the abdomen by means of a sterile syringe; also ordered pulv. ipecach., grs. x.

March 1st.—Was delirious, and trying to get out of bed all last night. Temperature this morning 101° F. Pulse 96. Motions, nine during the night of similar character to those passed yesterday, and three of these were passed in bed.

Patient is now quite himself, tenesmus not nearly so marked, looks better, lies comfortably in bed.

March 3rd.—Stools have greatly decreased in number, and now consist of blood clot, mucus, and liquid faeces. States he is now quite free from pain. Temperature normal. Treatment: Milk decreased, ordered barley water and beef-tea. Pulv. ipecach. co., grs. x., at night.

I may as well mention here that in all these cases milk was decreased

on the day after admission, *i.e.*, as soon as diagnosis was certain, and half a pint of barley water and two pints of beef tea substituted.

March 5th.—Only two stools last night, liquid, but entirely free from blood and mucus.

March 8th.—Stools average two a day since last note, and, with the exception that they are somewhat loose, are quite natural. Is now allowed up for four hours, and put on stewed chicken diet.

March 9th.—Is to-day covered with a rash like measles, and intensely irritating; was ordered calcium chloride, grs. xl.

March 10th.—Rash faded, irritation not nearly so marked. Patient continued to improve, the rash had completely gone on the 12th, and he was discharged to duty on the 20th.

The serum was prepared by the Lister Institute of Preventive Medicine, and was obtained from horses highly immunised against the dysentery bacillus of Shiga and Kruse and toxins elaborated by the bacillus.

CASE 2.—April 2nd. Lance-Corporal McL., admitted to-day complaining of “diarrhoea and passing blood with great pain while at stool.” States he has been “two days ill and has been going to the rear every ten minutes and passing only blood and slime.” On examination, abdomen somewhat distended, but quite flaccid; slight pain on pressure in the left iliac region. Temperature 99° F. Pulse 84. Put to bed; ordered plain milk and soda. At 6 p.m.: Has had three motions, small, and consisting of blood and mucus; has suffered greatly from tenesmus. Treatment: Skin and syringe having been sterilised, 20 cc. serum injected.

April 3rd.—Temperature 104° F. Pulse 100. Motions: Fourteen last night, of much the same character. Now complains greatly of headache. Treatment: Sponged. Temperature falling to 101·8° F.; ordered brandy with caffeine and phenacetin.

April 4th.—Temperature 98·6° F. Pulse 66. Was very restless all last night, but says he now feels better. Passed seventeen stools last night consisting of blood, mucus, and blood clot. He is now almost free from tenesmus.

April 5th.—Nineteen stools during the night, blood in all being in the form of clot. The latter motions also contained liquid fæces. He is entirely free from pain and says “if the diarrhoea would only stop he would be all right.”

April 6th.—There were only nine stools during the night, all free from blood, but there is still a little mucus. He is, however, to-day covered with a rash similar to former case and very irritating. Ordered calcium chloride, grs. xxx.

April 8th.—Rash has disappeared; only one stool yesterday, semi-formed, and quite free from mucus.

From this date, till his discharge on the 19th, there were no symptoms worthy of record.

CASE 3.—April 23rd. Lance-Corporal L., admitted this morning

about 11 a.m., complaining of passing blood and mucus, with some pain during the motion. States he has been two days ill, and on the 21st he had about fifteen stools, and yesterday about twelve. Very anæmic. Tongue coated. On examination, temperature 98° F.; pulse 96, weak; respiration 20. Sweating freely; great pain on slight pressure in the left iliac region; abdomen not tympanitic, heart's sounds weak, lungs normal. 6 p.m.: Four stools since admission, small and consisting of blood, mucus and traces of fæces. Complains greatly of tenesmus. Treatment: Was placed on plain milk diet with soda and brandy, *℥iii.*, also mag. sulph., *℥ii.*, four times during the night, and to be given every two hours to-morrow.

April 29th.—This treatment was continued till to-day. There has been on an average about ten stools in twenty-four hours, each intensely painful; character unchanged. To-day, 20 cc. of the serum were injected, with the usual precautions.

April 30th.—Slept fairly well last night. Temperature rose to 100·2° F. Pulse 100. Six stools during the night.

May 2nd.—States he feels ever so much better now and certainly has lost his anxious expression. There is now no tenesmus, and the three motions last night consisted largely of liquid fæces, mucus, and traces of blood clot.

May 11th.—Has on an average ten stools a day now, entirely free from blood and mucus. Is still very anæmic and somewhat emaciated. Is now getting fish, eggs, &c.

May 15th.—Was to-day put on stewed chicken.

Although patient has now quite recovered, he remains in hospital and he is still very anæmic. He continued to gain in weight and strength until May 29th, when diarrhœa again started and blood and mucus appeared in the stools. Serum was for the second time injected, diarrhœa and other symptoms of dysentery ceased two days afterwards. He was discharged to duty on June 1st. It will be noticed that although 40 cc. were injected no rash of any kind appeared.

CASE 4.—May 6th. Private R. was admitted this morning complaining of diarrhœa, accompanied with blood and mucus, of severe pain in the rectum, greatly increased while at stool, and of pain down the back of both legs. Illness began yesterday morning, and says he has been going to stool two or three times an hour since. Noticed blood and mucus in the stools this morning, so reported sick. On examination, temperature 97·6° F.; pulse 80, feeble. Abdomen somewhat tympanitic, pain on slight pressure all over; no rigidity, no tumour or other abnormality. Treatment: Bed, plain milk and soda, brandy, *℥ii.* 6 p.m.: Twenty-one stools since admission, small and consisting of blood and mucus. Tenesmus has been very marked. Lies curled up in bed, has a very anxious look and is sweating freely. It is very evident that he is suffering and has suffered greatly since admission. Treatment: The usual precautions

were taken and 20 c.c. of the serum injected, also ordered pulv. ipecac. co., grs. x., and brandy, $\mathfrak{z}\text{ii}$.

May 7th.—Eight motions last night; no change in character. Did not sleep at all. Temperature this morning $99\cdot8^{\circ}$ F. Complains of headache.

May 8th.—Eleven stools yesterday, and nine during the night. Traces of fæces in all those passed during the night, and blood is all in form of clot. Looks a different man; states he is entirely free from pain. Temperature rose last night to $100\cdot8^{\circ}$ F., but is now normal.

May 10th.—Five stools yesterday and only one during the night; these were all free from blood, and the motion last night was also free from mucus.

May 16th.—He is now convalescent; stools quite normal. Was to-day put on stewed chicken diet.

May 24th.—Was to-day discharged to duty. On the 18th a very irritating rash, similar to other cases, appeared on legs, arms and buttocks. Calcium chloride, grs. xxx., was ordered, and the irritation, ten hours afterwards, was ever so much less. Rash had gone on the 21st.

CASE 5.—May 10th. Private B. was admitted to-day complaining of passing blood and mucus, of tenesmus, and pain all over the abdomen. Illness began on the 8th with diarrhœa. On that day he had about twelve stools, on the 9th about twenty, and was in "agony" while at stool, the pain causing him to cry out and sweat freely. This morning he began to pass blood in large quantities, so he reported sick. On examination he is anæmic, and has a pinched expression. Seemed in great pain. Tongue coated, breath foul, lungs normal, heart's sounds somewhat faint. Temperature $97\cdot8^{\circ}$ F. Pulse 78, weak. Treatment: Bed, plain milk and soda, brandy, $\mathfrak{z}\text{iv}$. When seen again in the evening he was lying doubled up in bed, and seemed in great pain. Since admission there have been seven stools, all small, and consisting of liquid blood and mucus. Tenesmus has been a marked feature. Treatment: The abdomen and syringe were sterilised and 20 cc. anti-dysenteric serum injected. He was also ordered a Dover's powder, grs. x.

May 11th.—Seems somewhat better to-day; does not complain so much of pain, and tenesmus was not so marked with the four motions during the night. Temperature 98° F. Pulse 72.

May 12th.—Eight stools during the day yesterday, all containing blood in the form of clots. Four motions during the night, consisting of blood clot, mucus and traces of fæces. States he is now quite free from pain. Lies naturally in bed. Temperature last night $100\cdot2^{\circ}$ F., and he was then complaining of headache, for which caffein and phenacetin were ordered. Temperature this morning sub-normal. Pulse 80, good.

May 14th.—At 6 p.m. yesterday he passed a motion entirely free from blood, but still containing mucus. Is now entirely free from tenesmus. Had a good night; no motions.

May 18th. Only one stool, quite natural, a day now. This morning

he is covered with a rash, similar in all respects to the other cases. His hands were to-day bandaged, as he had caused bleeding in places, the rash being very irritating. Ordered cal. chloride, grs. xl.

May 20th.—Rash has almost disappeared, and there is no irritation. Was put on stewed chicken yesterday.

May 24th.—Discharged to duty to-day.

CASE 6.—May 11th.—Private W. was admitted to-day, complaining of “terrible pain while at stool,” of diarrhœa, and “passing blood and slime.” Illness began suddenly yesterday morning with pain in the abdomen, then diarrhœa and tenesmus commenced. First noticed blood in the stools this morning. Since yesterday he has had about thirty stools. On examination, a well-developed man; tongue dry and coated. Lungs normal. Heart’s sounds weak, but quite free from murmur. Pain on slight pressure all over the abdomen, which was somewhat tympanitic. No other abnormality discovered. Lies doubled up in bed, sweating freely. Temperature 98·4 F. Pulse 80, weak. Treatment: put to bed, ordered plain milk and soda. 6 p.m.: patient has had seven stools, the first small, and consisting of blood only, others of blood and a large amount of mucus. The usual precautions were taken, and 20 cc. serum injected.

May 12th.—Four stools during the night; tenesmus less. No change in character of motions. Temperature normal.

May 13th.—Looks ever so much better. Temperature last night 100·4° F. Had a severe headache then, and so was ordered caffein and phenacetin. Temperature this morning sub-normal. Twelve motions yesterday, consisting of clotted blood, mucus, with traces of fæces. Only one during the night; does not complain of pain.

May 15th.—He is now quite free from tenesmus. Four motions last night, consisting of liquid fæces and mucus. 6 p.m.: only one stool since 9 a.m. this morning, liquid in character, but free from blood and mucus.

May 18.—Patient is now convalescent. Was put on solid food to-day.

May 19.—Last night was covered with a rash, and was complaining greatly of the irritation. Cal. chloride, grs. xxx., ordered, and this was repeated this morning as there was still a good deal of irritation.

May 24th.—Rash had disappeared on the 22nd; discharged to duty to-day.

Remarks.—These six cases were evidently all due to Shiga’s bacillus. In the first three cases a bacillus having the same staining, microscopical and cultural properties was observed; that is to say, it was decolourised by Gram’s method, but stained readily with ordinary aniline dyes, it was rod-shaped, had oval ends, but I cannot say whether it was motile or not. On gelatine plates a whitish delicate growth with slightly wavy margins was noticed. Stools from every case were examined for amœbæ, but none discovered.

The advantages of this method of treatment are, I think :—

(1) The almost immediate relief from tenesmus ; (2) Its rapid beneficial action, blood first disappearing from the stools and then mucus ; (3) freedom from relapse of the disease, all patients have remained quite well ; (4) the absence of nausea, vomiting and depression, &c., caused by the treatment with ipecacuanha in large doses. The disadvantages, if such a word can be used, are none of them serious.

It will be noticed that there was a slight rise of temperature, headache, &c., in each case after the injection. In one case temperature rose to 104° F., but fell to 100°8 F. after sponging. These "disadvantages," however, only lasted a day or two.

There was some delirium in one case, only lasting for a night.

A rash appeared in every case except one, and was very irritating, but this could be readily controlled by calcium chloride in large doses.

REPORT OF A CASE OF FEMORAL AND INGUINAL HERNIA ON THE SAME SIDE, IN WHICH RADICAL CURE OF THE FORMER WAS DONE BY A NEW METHOD.

By MAJOR F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

PRIVATE S. was admitted to the Military Hospital, Colchester, on January 20, 1906, with a femoral and an inguinal hernia on the right side. The latter was well marked, and had been present for several years. The former was a large bubonocoele.

The femoral hernia was exposed by the usual vertical incision. The walls of the crural canal were developed to an extraordinary degree, and formed a very distinct sac. This contained a structure which at first sight looked like a coil of intestine, but closer examination showed it to consist of a sac proper, coated thickly with fatty tissue. The inguinal hernia was now dealt with by extending the first incision upwards and outwards, and the aponeurosis of the external oblique divided over the inguinal canal. There being no proper sac, the conjoined tendon and muscles were drawn across by kangaroo tendon, and sutured near Poupart's ligament after MacEwen's method, and the divided aponeurosis sutured with the same material. Before doing this, the sac of the femoral hernia was seized in a pair of forceps and pushed from below upwards, out of the crural canal. The structures which lay between it and the upper edge of Poupart's ligament were then scratched through, the sac pulled out, transfixed and tied with kangaroo tendon. The excess was cut away, and the stump dropped. Three deep sutures of kangaroo tendon were then passed through the crural ring, Poupart's ligament,

and the pectineal fascia and superficial fibres of the muscle. On being tightened they completely closed the crural ring.

The operation was suggested to me by Lieutenant Painton, R.A.M.C., who was assisting.

A CASE OF GUNSHOT WOUND OF THE HEAD.

BY LIEUTENANT E. M. GLANVILL.

Royal Army Medical Corps.

THE following case of gunshot wound of the head (self-inflicted) may be of interest from a medico-legal point of view, as the position of the wounds was peculiar. The importance of noting collateral circumstances when on the medical evidence may depend the answer to the question: "Accident, suicide or murder?" was also emphasised.

I was called to the barracks, two miles away, and on arrival found, in a barrack room, the dead body of a private soldier lying on its back on two bed-boards placed side by side, on supports about a foot high, the feet resting on a similar bench at right angles to the first. The head, which was covered with a cloth, was much mutilated, evidently as the result of a gunshot wound. The right foot was bare. Half the barrack room in question was disarranged, as the result of festivities the night before, and at this end the body lay. The other end of the room was stated to have been full of men when the shot was fired. All the evidence that could be obtained from those who were in the room at the time was to the effect that they heard a shot fired, and saw the deceased, who was sitting on the form above referred to with his rifle, fall backwards.

On examining the body a small entrance wound was found in the *back of the head* and a large exit wound between the eyes. The entrance wound was situated three inches behind the right ear. It was just large enough to admit a rifle bullet and was clean cut and circular. Blood was welling from it. No singeing of the hair could, however, be seen. The surrounding parts were not lacerated in any way. The exit wound was situated between the eyes at the root of the nose. It was a large wound of irregular shape and four flaps of skin were everted over it, giving the wound a star-shaped appearance. Neither of the eyes had been damaged, though the left orbit was opened into. The bone was considerably lacerated and no singeing of the skin could be observed.

On inspecting the rifle, which was standing in a corner of the barrack room near the body, a loop, formed by a boot-lace, was found attached to the trigger. The right foot had already been noticed to be bare, and after some search, the right boot was discovered at the other end of the barrack room minus a boot-lace. The bullet mark was found in the roof above and slightly behind the spot where the man was sitting when the shot was fired. It thus became evident that the rifle must have been

placed between the legs, the muzzle behind the right ear, and the head thrown back and inclined to the right. The shot was fired by the right foot in the loop attached to the trigger. As the shot was fired the man fell backwards, which accounted for the fact that the bullet hole in the roof was slightly behind the spot where he was sitting.

Accident was excluded by the evidence of premeditation presented by the bared right foot and the boot-lace attached to the trigger. The position of the bullet hole in the roof rendered it certain that the shot could only have been fired by the deceased himself. Had the bullet hole in the roof not been discovered it might have been difficult, in view of the position of the wounds, to say definitely that the wound was self-inflicted, an opinion in accordance with which the Coroner returned a verdict.

Travel.

KEEPING A PONY.

BY LIEUTENANT W. C. RIVERS.
Royal Army Medical Corps (H.P.).

HE was behind a hedge when I first saw him, cropping stiff, khaki-coloured grass, a diet which it was his wont to eke out, or so station gossip said, with thatch from the bungalow of his frugally-minded host. His owner, suddenly sent home, had no choice but to hope for the best as regards a speedy sale, steadily to disburse the English equivalent of Rs. 20 a month for livery, and periodically to advise the insertion in the *Pioneer* of a carefully worded advertisement respecting the accomplishments and price of "Meteor: ch. a. g., I.P.A.C." One comfort the unlucky man had, the reflection, namely, that against the cost of keep could be put the virtual certainty that no accident could befall his property; for it is an Anglo-Indian convention that if you keep a man's horse for him, you can only make a charge for doing so in the event of your not using it. So the pony spent his days in the compound, and his nights (it being the cold weather) in one of a row of mud-and-plaster-walled, tile-roofed loose boxes, each, except for being undetached, designed as a Devonshire "linhay" is said to be, bars of bamboo closing the entrance. When of a morning these were withdrawn, and he sallied forth, bedecked with eyefringes, thorn hedges kept him from straying, and maybe making acquaintance

with the cantonment pound, to which the barefoot native police brought sorry "tats" and an occasional blue-eyed buffalo calf.

Even if, effecting his escape, he had come to some slight grief, it was unlikely that his value would have been much depreciated. Arabs will stand a good deal of galloping on hard ground; and broken knees, which wait on them much as measles on English children, he had already suffered. The analogy may be pushed a little further, for whereas parents often blame nurses for their children's illnesses, so (if Anglo-Indian horse-masters are to be believed) the etiology of chipped knees is a very simple matter, invariably centring in the misdoings—ranging from a trifling dereliction of duty to deliberate violence—of some "sais." And "Meteor's" case was only exceptional in that there were several eye witnesses to his mishap, from whom those interested (the whole of station society at the time, its horse-coping members subsequently) heard how the "sais" failed to prevent the pony from getting jammed between a "bullock-tonga" and a gate-post. Some ill-luck there may have been, for the man's reputation for ability was good enough. In general, though, he was looked at a little askance, by his equals as a relic of a band of undesirable aliens brought in its train by a departed regiment to take the rice out of the mouths of local industry, by superiors because he was member of a criminal tribe. This was the man, standing near six foot, weighing (apparently) some nine stone, and upright as a dart, who brought the pony over to my stable.

The pair was passed on to me simply because "Meteor's" former guardian got orders for a station a thousand miles or so distant; he proceeded to pack up and betake himself thither with what seemed, to the unexpanded European mind, a high degree of nonchalance. For my part, I saw the two new-comers installed each in his respective quarters in the "godown," it striking me at the time that the quadruped had a good deal the best of things, especially as regards ventilation. From such sociological observations it became necessary to turn to the consideration of a problem: how, namely, to remove from the pony in as short a time as possible the traces of a long run on Central Provinces grass. Every rib on his rather flat sides was showing; he had a Struwwelpeter mane and no shoes. With the absence of imperiousness, then, which distinguishes the lately-landed "sahib's" directions to native servants, measures were prescribed to meet immediate necessities. The same evening the club library was searched, Delisle and other authorities consulted. To learn how boiled barley should be prepared, however, one had no

need to go to books. Why is it that men (and even more, some women) are so ready to "talk horse," nearly as ready as philosophers have noticed the former to be to talk self? The young horse-master need never fear dearth of advice. And so from a mixture of motives, in which kindly consideration (for the pony, perhaps, as well as for me) was often evident, a good deal of it was tendered; some being accepted. The little chestnut, they said—and "they" knew all about him, public opinion is at least correct about a horse's character—was not a very good doer, pulled rather, and played polo best in a "IX. Lancer." It was afterwards discovered that in connection with the last two words the word "bit" was understood. Nobody would say that he was the fastest pony in the place, not because (as was the case) this was rather doubtful, but because everybody interested enough to be likely to give an opinion was committed, for regimental or private reasons, to the support of some other animal, "Meteor's" partisans all having left the station. But no one sneezed at his speed. Indeed, he was a tournament pony, and had once pleased all and sundry by beating an unpopular person's waler. It was at this stage of affairs that one began to make the discovery that horse-ownership was not essential to the development of those foibles, some of which have been touched on above. Mere guardianship seemed quite sufficient. One caught oneself getting rather communicatively enthusiastic about obvious good points, such as the width the pony "went" behind in his gallop. Well, probably most Anglo-Indians of a few months' standing are apt to grow a little cock-a-hoop over the first Arab they have to do with, for these little horses are very fascinating. Their high-bred air, their brilliant coats, their Oriental docility, the way they stand the climate—all these attributes strike a new-comer very much.

Meanwhile, "Meteor" was becoming transmogrified. In nice white girths, and leather and pigskin fresh from the Haymarket, he looked more respectable and conventional, if less Asiatic and picturesque, than when, ridden by a black man in a white turban and not very much beside, he first walked into the "doctor-sahib's" compound. But condition came rather slowly. Here again, as over the broken knees, one could not help noticing a certain monotony; I mean that with which people laid down the axiom (often justified, no doubt): "thin pony, fat 'sais'; thin 'sais,' fat pony." Before very long, however, the barley porridge began to take effect. The occasion on which I admired him most was at some small station polo-match, gymkhana, or race-meeting; I forget

which. It is at such athletic-social gatherings, by the way, that the Anglo-Saxon race itself looks its best, according to Bourget's politely expressed yet double-edged criticism of us. "Meteor" was being led away in company with a rather coarsely bred waler, and the contrast between them was very strong. The Arab stalked along, moving from hip and shoulder, with head aloft and his beautifully set-on tail carried like a banner, while a little behind him the Australian horse ducked and shuffled. Very likely the colonial was a much better hack, though, for "Meteor" never could be persuaded to "trot on," or to walk in a hurry. But take the little Arab all in all he was well worth the keeping; indeed, I was selfishly sorry when somebody bought him, and one morning, in the hot weather ("one fine morning" one had nearly written), "sais" and pony again set out together to serve a new master.

Echoes from the Past.

THE LAST MOMENTS OF LORD NELSON.

[THIS interesting account of the last moments of Lord Nelson is abstracted from a volume of *The Medical and Physical Journal* of 1805, now in the library of the Military Hospital, Shorncliffe. The book, which at one time belonged to Sir J. M. MacGrigor, Bart., was presumably presented by him to the hospital. In the copy of the engraving the ball is a little larger than in the original.—E. M. HASSARD, Major, R.A.M.C.]

"To the Editors of *The Medical and Physical Journal*.

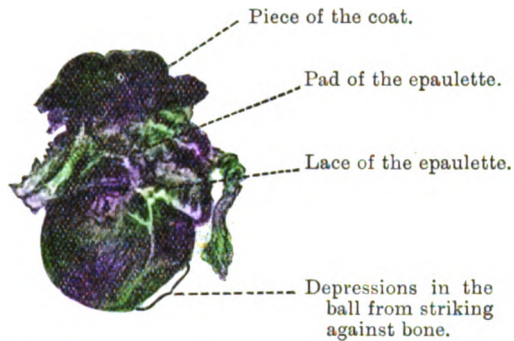
"GENTLEMEN,—I beg leave to transmit you a statement of the scite and nature of the wound which produced the death of the exceedingly lamented and late illustrious hero, Lord Nelson; and request that you will please to insert it in the next number of *The Medical and Physical Journal*; enclosed is likewise a drawing of the fatal ball, with its appendages, which were carried before it through the whole course it described. (*Vide* Engraving.)

"I am, &c.,

"W. BEATTY, Surgeon.

"*H.M.S. Victory, December 15th, 1805.*"

"About the middle of the action with the combined fleets on the 21st of October last, the late illustrious commander-in-chief, Lord Nelson, was mortally wounded in the left breast by a musquet ball, supposed to have been fired from the mizen top of 'La Redoubtable,' French ship of the line, which the 'Victory' fell on board of early in the battle; his Lordship was in the act of turning on the quarter deck, with his face towards the enemy, when he received his wound; he instantly fell, and was carried to the cockpit, where he lived about two hours. On his being brought below, he complained of acute pain about the sixth or seventh dorsal vertebra, of privation of sense and motion of the



THE BALL WHICH KILLED LORD NELSON.

body and inferior extremities; his respiration short and difficult, pulse weak, small and irregular; he frequently declared his back was shot through; that he felt every instant a gush of blood within his breast, and that he had sensations which indicated to him the approach of death.

"In the course of an hour his pulse became indistinct, and was gradually lost in the arm; his extremities and forehead became soon afterwards cold. He retained his wonted energy of mind and exercise of his faculties until the latest moment of his existence; and when victory, as signal as decisive, was announced to him, he expressed his pious acknowledgements thereof and heartfelt satisfaction at the glorious event in the most emphatic language; he then delivered his last orders with his usual precision, and in a few minutes afterwards expired without a struggle.

"Course and scite of the ball, ascertained since death:—

"The ball struck the fore part of his Lordship's epaulette, and

entered the left shoulder immediately before the processus acromion scapulæ, which it slightly fractured; it then descended obliquely into the thorax, fracturing the second and third ribs; and after penetrating the left lobe of the lungs, and dividing in its passage a large branch of the pulmonary artery, it entered the left side of the spine between the sixth and seventh dorsal vertebræ, fractured the left transverse process of the sixth vertebra, wounded the medulla spinalis, and fracturing the right transverse process of the seventh vertebra, it made its way from the right side of the spine, directing its course through the muscles of the back, and lodged therein, about two inches below the inferior angle of the right scapula. On removing the ball, a portion of the gold lace and pad of the epaulette, together with a small piece of his Lordship's coat, were found firmly attached to it."

Reviews.

THE URETHROTOMIES AND KIDNEY CAPSULOTOMY. By Reginald Harrison, F.R.C.S. London: John Bale, Sons and Danielsson. Pp. 96, 20 illustrations. Price 2s. 6d. net.

To all officers of the Corps in active performance of professional duty we recommend this little book. Though the book itself is small the directions for sound practice are much fuller than will be found in most text-books. The directions given for the treatment of those imperative emergency cases of complete retention with apparently impassable stricture, and again for those cases of extravasation with still effectual stricture, are most excellent, though we miss any reference to the continuous warm bath treatment for the latter class of cases, continued if need be, for several weeks, such as we have found to be of inestimable advantage more than once.

The description of the operation of internal urethrotomy is very full and good; it gives a tyro all the information he wants when left to his own unaided resources; as a preliminary, Mr. Harrison prefers internal administration of magnesian boracite for three or four days.

The teaching as to what should be done for ruptured urethra is one of the most important parts of the book, the great and very obvious advantages of immediate perineal section and drainage are so clearly stated; by this means are avoided: (1) subsequent stricture; (2) extensive and progressive extravasation with possibly (or most likely) fatal sepsis; and all will agree with the author as to the rarity of stricture after perineal lithotomy on the one hand, and its frequency and severity after undrained rupture of the urethra. Then we would quote: "It

is a good rule that cystoscopy of the terminals of the ureters should precede all kidney explorations."

To be inquisitive for a moment; in instances where the capsule is incised for the relief of tension, does the "blood spurt out in jets" synchronously with the arterial pulse, with respiratory movement, or is the impulse arrhythmical with both of these? We are convinced that many cases of acute nephritis should be treated surgically without delay.

M. P. HOLT.

WAR WITH DISEASE. By F. F. McCabe, M.B., Surgeon-Lieutenant in the South of Ireland Imperial Yeomanry, and formerly a Civil-Surgeon, H.M. Field Force, South Africa. Messrs. Dollard and Co., Dublin. Price 6d. Fcap. 8vo, pp. 78.

[We have received two reviews of this book and publish both.—Ed.].

First Review.

This little book of 78 + vi. pages consists of four lectures given by the author during the present year to the officers and N.C.O.'s of the Cavalry Brigade in Ireland. They are written in a popular and interesting manner, and were no doubt listened to attentively. The subject matter consists of a short description of the modes of causation of some of the commonest diseases to which troops are liable, and an effective exposition of the chief measures that should be adopted to prevent their spread. In this way enteric fever, tuberculous diseases, zymotics, venereal, and tropical diseases are dealt with; and the last lecture treats of Personal and Camp Hygiene. The author is thoroughly in earnest, and if he has succeeded in inspiring his audience with some of his own enthusiasm, will have done a good work. In all essential points we regard Mr. McCabe's teaching as sound. In his very first page he strikes the right keynote in laying down to his audience of combatants that "your medical officers advise you on sanitary matters, but with you must ever remain fixed the responsibility of deciding what steps you will, or can, take, for the protection of the health of the troops under your command." This is the principle that has been insisted on in the lectures on these subjects that have been given during the last two or three years to officers at different stations at home and abroad; and we are convinced that when Commanding Officers (of whatever rank) thoroughly realise their responsibility in this matter, they will take as much interest in the health of their men, and the sanitation of their barracks and camps, as they do at present in their marksmanship and discipline.

There are one or two points to which exception may fairly be taken. There are many sanitarians of wide experience and sound judgment who do not believe that drinking water is practically the only mode of propagation of enteric fever, though on p. 11 the author appears to think they are all either incompetent or lazy. We can assure him that this is not the case. We quite agree, however, with his condemnation of the attitude, formerly too common amongst officers of all branches of the Service, that it is useless to try to prevent men drinking water anywhere and anyhow, when they are living under the conditions of field service. We believe that the soldier *can* be induced to be careful, if it is properly explained to him *why* he should take care of his health,

and if pure drinking water is provided in reasonable quantity. A most important factor in achieving this result is, however, not mentioned by Mr. McCabe: this is, that troops should be systematically trained to repress the natural desire to drink directly they feel thirsty; they should be trained by "water discipline" on field days and at manœuvres, just as they are trained by "fire discipline." Up to the present no attempt on any considerable scale has been made to cultivate this necessary self-restraint; it is a matter of common knowledge that most young soldiers empty their water bottles early in the day, if it is hot weather; they should be trained to make their water bottles last them all day long. They would then under Service conditions be better able to withstand the temptation of drinking the first water they get access to.

The prevention of enteric fever is hardly so well dealt with as the other diseases that are considered. There are some sensible remarks on venereal diseases. It is, perhaps, difficult to explain the cycle of development of the malarial parasite in a few words and in popular terms, as has been attempted on p. 44. The body of *Anopheles* does not stand out "at right angles from the wall." Camp hygiene is dealt with rather hurriedly, and if the lecturer had told his audience "a lot about different types of filterers (*sic*), common places about latrines, and the usual admonitions about the necessity of keeping your lines clean" (p. 67), instead of refraining from doing so, no doubt he could have made it interesting enough to prevent their attention wandering, as he seemed to anticipate: these matters can hardly be passed over in silence.

In the main, however, these are excellent lectures, and the author is to be congratulated on having brought a good deal into a small compass, and made the subject "alive." We must complain of the very large number of misprints, which, in a book of eighty pages, ought not to have been allowed to pass: "dysentery" occurs *passim* (perhaps in anticipation of the new American method): "diphtheria," "anthenæ," "larvæcides," "elephantisis," "propylectic," "abcess," "diagphragm," "fæces is": these are only some of the press errors which need correction when a second edition of this little book is called for, as we hope and expect will be the case before long.

Second Review.

The subject matter of this pamphlet is that of a series of four lectures on Preventive Medicine, given by Mr. McCabe to the officers and N.C.O.'s of the 3rd Cavalry Brigade in Ireland. The lectures have evidently been given by a man thoroughly in earnest, and are expressed in language at once simple and forcible, which cannot have failed to stimulate interest in a subject upon which the Army at large cannot be too systematically informed. These lectures present no novel features, and are similar in scope and aim to those which have been given during the past two years by officers of the Royal Army Medical Corps in various garrisons at home and abroad, but they lack detail as to practical measures to be taken by the hearers in order to secure the obvious aim for which the lectures are given. Officers and others giving addresses of this kind to soldiers cannot give too much practical detail, and must remember ever that mere theorising and discursive talk about germs and dirt will not solve the problem of practical sanitation in the Army. We

want practical exemplification of methods and not mere pseudo-scientific verbosity. The text of this book is marred by numerous errors in spelling, and the interpolation of much irrelevant matter, while the force and value of the principles enunciated are discounted by the author's apparent inability to grasp the fact that if the Army medical officer is to get carried out what he knows must be done, he must be a man of action and not a mere advisory theoriser of pseudo-scientific platitudes. The time has gone by for him to be content with the rôle of the supplicant, that attitude has been tried too long; but, strong and confident in the knowledge which his training and experience have given to him alone, he must insist in no ambiguous way upon his views and wishes being carried out, and be prepared to put his ideas into action. In other words, the Army medical officer and those who, in time of national stress, are affiliated to him, must recognise that the primary function of the medical corps is not to treat disease in the Army, but to take steps that there be as little disease as possible to encumber that Army and for the medical service to treat and succour.

Current Literature.

A New Pathogenic Trypanosome from the Upper Niger.—In *Le Caducée* for September 15th Laveran describes the results of his studies, conjointly with those of Messrs. Cazalbou and Pécaud of the French Army Veterinary Department, on the forms of trypanosomiasis found in the Upper Niger districts, where these diseases have made great ravages amongst the cattle, horses and camels.

In 1904, Cazalbou described three forms of trypanosomiasis found in the French Soudan, under the local names of *Mbori*, *Souma* and *Baleri*. Laveran has proved that *mbori* is only a form of surra; but as the trypanosome of *souma* appears to be a new species he has named it *T. cazalboui*. This latter, including its flagellum, is $21\ \mu \times 1.5\ \mu$ in length; the nucleus is oval, situated near the centre; the rounded centrosome, clearly visible, is situated near its posterior extremity, which is rounded, not pointed. In stained preparations the protoplasm shows fine granulations; the undulating membrane is not much developed and shows little folding; it is bounded by the flagellum, which has a free extremity. Division, which is by bipartition, commences generally at the centrosome. From its pathogenic action on different animals, *T. cazalboui* is readily distinguished from allied species. It is found as a natural infection in horses and cattle; the smaller ruminants (sheep, goats, antelopes) are readily infected, but inoculations made on rodents (mice, rats, guinea-pigs) and on dogs, were generally without results. The Macina district appeared to be the active centre of *souma*, which has also been observed at Bamako and at Kati. According to Cazalbou and Pécaud the disease is propagated by *Tabanus*, which abounds in Macina, especially on the banks of the Niger, whilst *Glossina* is rare there.

J. E. NICHOLSON,
Lieutenant-Colonel (R. P.).

Temporary Disappearance of Nagana Trypanosomes in Infected Dogs.—Messrs. Roux and Lacomme, in *Le Caducée* for September 15th, quote a series of experiments which prove that, in animals affected with nagana, the spleen is an active agent for the destruction of trypanosomes; furthermore, the spleen would appear to exercise a *trypanolytic action in vitro*, which gave them the idea for the following experiments.

Three dogs were inoculated with *Trypanosoma brucei*. In from six to eight days trypanosomes appeared in their blood in readily appreciable quantities. The animals were now inoculated under the skin with an emulsion of triturated fresh bullock spleen, and in from two to three days afterwards all traces of trypanosomes had disappeared, and only again reappeared after an interval of five days. This was an absolutely new phenomenon, and suggested the possibility of causing a complete disappearance of trypanosomes from the blood of infected dogs by means of repeated injections of spleen emulsion; 20 cc. of the liquid left after centrifugalising an emulsion of fresh bullock spleen were now injected into the saphena vein of a dog, whose blood showed an abundance of nagana trypanosomes, and caused a total disappearance of these trypanosomes from the third day after the intravenous injection.

J. E. NICHOLSON,
Lieutenant-Colonel (R.P.).

Review of Tropical Diseases.—(By Dr. R. Tanner Hewlett, M.D., F.R.C.P., D.P.H. (*The Practitioner*, October, 1906). In this review the following paragraph occurs (page 501): "Dutton and Todd (Liverpool School of Tropical Medicine, *Mem.* XVIII., 1906) have found that enlarged lymphatic glands, particularly in the neck, are a very constant feature in trypanosomiasis. By withdrawing some of the juice from such an enlarged gland by means of a hypodermic syringe, and examining it, a simpler and less laborious method of demonstrating the trypanosome is provided than by the examination of the blood, or cerebro-spinal fluid (Greig and Gray). So constant is the enlargement of the cervical glands in sleeping sickness that Todd (*Lancet*, 1906, ii., p. 6) considers that every native, in and near the infected districts, who shows these enlarged glands without obvious cause, must be considered to be a case of sleeping sickness until the contrary is proved."

This gives the credit of this important addition to our knowledge of sleeping sickness, an observation which so simplifies diagnosis as to enable the ordinary health officer easily to detect suspicious cases, to Dutton and Todd, of the Liverpool School of Tropical Medicine.

The credit of this discovery belongs to Captain E. D. W. Greig, I.M.S., and Lieutenant A. C. H. Gray, R.A.M.C., as the following abstracts will show:—

"They (Greig and Gray) found the trypanosomes to be far more numerous in the glands than in the blood or cerebro-spinal fluid, and believe that the examination of fluid removed from lymphatic glands will prove to be a much more rapid and satisfactory method of diagnosing early cases of sleeping sickness than the examination of the blood.

"At first the glands were excised, but this was soon found to be unnecessary, as it is easy to puncture a superficial gland with a hypodermic syringe, and suck up some of the juice into the needle, and blow this

out on a slide. The actively moving trypanosomes were readily found after a short search in these slides, when a prolonged search in similar preparations of the blood from the finger failed to discover them."—(*Proceedings of the Royal Society*, vol. lxxiii., April, 1904, p. 455).

"A practical outcome of these observations will be, that the recognition of sleeping sickness in its earliest stages will be a matter of easy accomplishment; the enlargement of the superficial lymphatic glands presents a sign which will arrest the attention of the observer, and the determination, by the above method, of the presence of trypanosomes in them can be very simply carried out."—"Reports of the Sleeping Sickness Commission of the Royal Society," No. VI., August, 1905, p. 8).

". . . . The incidence of gland enlargement in the sleeping sickness areas would be a gauge of the incidence of trypanosomes in the general population in sleeping sickness areas, because the majority of cases coming from sleeping sickness areas with enlarged glands have on examination showed the presence of trypanosomes in the glands."—(*Ibid.*, p. 12.)

Correspondence.

HAMMER TOE AND HALLUX VALGUS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—With your permission I must thank Captain Hull for drawing my attention to the foreign equivalents of the name given to the deformity under discussion. "Bred as I have been to stick slavishly to the Nomenclature of Diseases" (if I may borrow an apt phrase from Colonel R. H. Forman's notable article!), I must admit that I have confined my attention to the English terms of the Nomenclature without studying their foreign equivalents, thinking the English good enough for all ordinary diagnosis. I see now I have made a mistake, for had I noticed that the compilers of that somewhat complicated work of art considered a "hammer toe" was "a flexed great toe," I should never have endeavoured to explain, as I have to many, that "a hammer toe" was "a fixed, straight, hammer-headed great toe." To the many, and to your readers, I must therefore apologise. But I trust the discussion will not have been altogether without some good result in obtaining a uniformity of diagnosis, which was my original object in writing. "Hammer toe" is then, according to the Nomenclature, a deformity of the great toe, and not of the other toes. Hallix or Hallex, or Alex, being the Latin equivalents of *Pollex pedis*, or "the great toe." Nor must the name be applied to the deformity to which I referred, and which we often see in recruits. (Pending a better name for this, I would suggest *Hallix rigidus*.)

As regards the operation suggested by Captain Hull, viz., "excision of the head of the first phalanx" of the second toe, I cannot speak from

personal experience, but I am inclined to think the result will not be so satisfactory as removal of the second toe, since there will be more or less stiffness, which would be detrimental in walking and running; whereas I have not found removal of the second toe causes any subsequent trouble to the recruit (who usually appreciates the fact that he has no longer a painful corn to trouble him), nor have I found its removal followed by *Hallux valgus* when proper sized boots with broad toes have been worn.

Yours very truly.

G. F. POYNDER,

October 14th, 1906.

Lieutenant-Colonel, R.A.M.C. (R.P.).

RESPIRATORY TRAINING FOR THE SOLDIER.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—In my article "Respiratory Training for the Soldier," published in the October issue of the Corps Journal, I failed to bring out a point of interest in connection with the height of the soldier, so I trust you will allow me to allude to it now.

In Quain's Anatomy, straightness of the spine is mentioned as one of the most important factors connected with respiration; it is also obvious that the straighter the spine is held the greater must be the height of the individual. Now, when the shoulders are unduly drawn back a more or less well-marked curvature is produced in the spine at the small of the back; in other words, the height is lessened. So the man with a fine hollow back has acquired a very much admired "appearance" at the expense, not only of his breathing powers, but also stature.

I find the argument about the loss of height specially appeals to short non-commissioned officers and men; but I must sorrowfully confess, in most cases, all my efforts have been in vain, for as soon as the men are out of hospital and back in barracks into uniform the kink in their backs becomes again more or less pronounced.

I am, dear Sir,

Yours faithfully,

Chatham,

October 13th, 1906.

R. F. E. AUSTIN,

Major, R.A.M.C.

ROYAL ARMY MEDICAL CORPS GAZETTEER.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—May I ask if the idea of the production of a *Royal Army Medical Corps Gazetteer* has ever been considered, in connection with the Corps Journal? We have not at present such a publication, and one would probably be found most useful in our Corps. Moreover, as officers

of the Corps are quartered at every military station, such a work would probably be found of wider interest, and useful to others outside the Corps. The following points show the nature of information such a publication might contain:—

(1) Brief description of station and surrounding country, climate, &c., barracks, hospital and composition of garrison; (2) number and nature of employment of officers, detail of detachment Royal Army Medical Corps; (3) information regarding extra pay, allowances, rebates, &c.; (4) what clothing, &c., is necessary for the voyage out? (5) how does one put up on first arrival? (6) information regarding quarters, or facilities for obtaining houses, with rental, &c.; (7) what clothing is worn at the station: (i.) uniform, (ii.) plain clothes? What should be brought from home, and what can be obtained locally? The same for ladies and children; (8) what furniture is necessary, what can be obtained locally, and what should be brought from home? (9) information regarding servants required, with pay, &c.; (10) what arrangements are there for leave, and where can leave be spent? (11) information regarding society, clubs, sport, and recreation at the station. Shooting, hunting, fishing, polo, golf, tennis, bicycling, motor cars or motor cycles. What should be brought from home in this connection? Any information regarding horses and traps, as to cost, &c.; (12) what are the arrangements for the education of children?

I trust that the subject may be of sufficient interest to warrant my troubling you, and bringing it to your notice.

I am, Sir,

Yours truly,

Aldershot,
September 14th, 1906.

THOS. EXTON, *Lieutenant and*
Quartermaster, R.A.M.C.

[This is an excellent idea, but would entail an enormous amount of work to do it forthwith. We receive from time to time accounts on home and foreign stations, and in time these various articles might be gathered together in one volume, and so form the gazetteer proposed.

Up to the present we have published descriptions, &c., of stations under the following headings:—

"Bermuda as a Garrison," by Major E. C. Freeman, R.A.M.C., vol. i., November, 1903.

"Hong Kong," by Major S. F. Clark, R.A.M.C., vol. ii., January, 1904.

"Bellary: Its Climate and Possibilities," by Lieutenant-Colonel H. K. Allport, R.A.M.C., vol. ii., February, 1904.

"Ceylon as a Foreign Station," by Colonel (now Surgeon-General) R. H. Quill, R.A.M.C., vol. ii., May, 1904.

"St. Lucia, West Indies," by Lieutenant-Colonel F. P. Nichols, R.A.M.C., vol. iii., September, 1904.

"Hints on Service in Ceylon," by Major F. M. Begbie, R.A.M.C., vol. iii., November, 1904.

"Ranikhet and the Districts of Kumaon and Garhwal," by Lieutenant-Colonel C. E. Nichol, D.S.O., R.A.M.C., vol. iv., March and April, 1905.

"The British East Africa Protectorate," by Quartermaster-Sergeant R. Stanley, R.A.M.C., vol. vi., January, 1906.

"Cliffden, Murree Hills, as a Hot Weather Station for Families," by Captain R. H. Fuhr, D.S.O., R.A.M.C., vol. vi., May, 1906.

And we shall be happy to receive further notes on other stations for publication.—ED.]

HORSE-SICKNESS IN THE ADEN HINTERLAND.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—I have ventured to write to you about a disease which has recently appeared here among horses and mules. Six of our mules and two ponies of the Aden Troop (two miles away) have died. The same disease is said to be prevalent in Kataba (Turkish), about ten miles from here.

The Arabs say that cattle and sheep are never attacked by the disease, and, so far, I have seen none with it.

When the disease first appeared, September 16th, I thought it might be anthrax, but I was very much struck with the resemblance some of the animals presented after death to the photograph of a horse, dead from horse-sickness, produced in the ROYAL ARMY MEDICAL CORPS JOURNAL for September, 1906.

The symptoms are dulness, loss of appetite, fever, and sometimes difficulty of breathing. After death many of the animals extrude white, frothy foam from the nostrils.

I have seen one *post-mortem* examination. The abdominal viscera all appeared to me to be normal. The lungs were congested, and the trachea and bronchi full of white, frothy mucus.

Microscopic examinations of blood, obtained from two of the mules during life, have proved negative.

I forgot to mention that the duration of sickness has been from five hours to just over three days, death following in every case up to date.

I am, &c.,

D'thala, Aden Hinterland, Arabia,
October 1st, 1906.

A. C. INGRAM,
Captain, I.M.S.

ERRATA.

VOL. VII., No. 5, November, 1906: In the "Report of a Case of Femoral and Inguinal Hernia on the Same Side," &c., by Major F. J. W. PORTER, D.S.O., R.A.M., page 515, the words "latter" and "former," which appear in the first paragraph, should be transposed.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

ESSAY ON MEDICAL ARRANGEMENTS IN WAR.

BY LIEUTENANT-COLONEL C. W. S. MAGRATH.

Royal Army Medical Corps.

(Continued from p. 471).

MEDICAL ARRANGEMENT.

THE next link in the chain is the Field Ambulance. For the work of this unit the light dooly should supplant the stretcher, because it can be carried farther, faster, and with greater comfort to the wounded man. No attempt should be made to combine the functions of bearer and dresser. The highly educated dresser has not the physical training to make an efficient bearer. The hands of the bearer are roughened and hardened, and quite incapable of sterilisation. To get the maximum of efficiency the bearer should do nothing but carry, and should be in hard training for his work, and the dresser should do nothing but dress, and should keep his hands in a fit state for it; on economic grounds the dresser is too expensive a man to be wasted on mere muscular labour. Each dooly should have six bearers, four to carry and two relief, and one dresser. The men available for bearers are: (1) Men of the Volunteer or St. John's Ambulance. (2) Ordinary civilians engaged for this special work. (3) Natives of the country in which the war takes place. (4) Indian "Kahars." The first two have had no physical training in the work, and their services can be better utilised elsewhere. The third would be expensive, and, unless

enrolled and trained beforehand, would be lacking in discipline, and hard to handle, as well as very inefficient bearers. The services of the fourth would probably have to be utilised to some extent on the outbreak of war; they might be good, bad, or indifferent (probably the latter), but their training would of necessity be hurried and perfunctory. The "Kahar" has many advantages, and I believe that the Gharwal "Jampani" is the best man for the purpose in the Empire. He is quite as accessible as the Englishman, and can be even more easily transported to the scene of action. He is much cheaper, both as regards pay and the transport required for his kit and tentage. He understands living in the open, is hardy, frugal, and amenable to discipline, and he is accustomed to carry heavy loads over the steepest ground. He could be taught in a few days to lift wounded and load the dooly, and all else that is of practical value he knows already. Of course, the drill would have to go, to a great extent, but it is about as useful in modern war as the old attack in column of companies, and there has been practically no drill in advance of the wagons on the field of battle for the past twenty-five years. The superior carrying power of the native may be doubted by some, but I do not think we have a man in the Corps who could carry a 40 lb. load twelve miles over rugged mountain country in a day; whereas any Gharwal coolie picked at random, would not only carry an 80 lb. load for that distance, but, for an extra rupee, would joyfully walk back to report its delivery.

The employment of these men, equipped with doolies under 40 lbs. in weight, would greatly increase the efficiency of a field ambulance. For hill warfare on exceedingly precipitous and difficult ground, neither dooly nor stretcher are much use, but a light net hammock stretched on the dooly pole will bring a wounded man down from all but the very worst places. The sides are tied up at intervals, so that the patient is practically lashed to the pole, and in this way he can be safely passed from hand to hand down very bad places, indeed, in far greater comfort than if carried in a coat or blanket. In exceptionally bad places it may be necessary to fix him on a bearer's back and assist the latter with a rope, or even lower both together. For this purpose a piece of stout fabric 92 inches long by 24 inches wide is split for 28 inches and the ends turned back for 21 inches, and sewn firmly across the width of the stuff, so as to leave two loops, through which the bearer's arms are thrust; the opposite end is split for 27 inches, and the two strips thus formed are sewn end to end, so as to form a single loop 27

inches long. The stuff is then folded in three at this point, so as to reduce its breadth to 4 inches. When the patient is placed on the bearer's back this loop is passed between his legs, drawn well up behind his back, passed over his head and arms, and lastly across the bearer's forehead. The wounded man is thus supported at the buttocks and under the armpits with his weight distributed to the greatest advantage for the bearer, whose hands are free for climbing or fending off his helpless burden from rocks while being lowered. There is no place into which a mountaineer could climb that four Gharwal coolies with this simple apparatus and a piece of rope could not get him out of, if wounded. The English bearer, Royal Army Medical Corps or other, could not go on to such ground at all. For the longer distances, too, our means of transport are not sufficiently flexible. In Manchuria wheeled ambulances were found useless; and we may at any time have to fight over as difficult a country.

Our present Resources—Cacolets and Stretchers.—The cacolet is a practical and useful though somewhat tiring conveyance for sick and wounded who are able to sit up, if carried by a camel, but it is too heavy for the ordinary mule and will soon soreback a large one. Each cacolet should have a water bottle and an umbrella in a light sheath as permanent parts of its equipment on service.

For helpless cases there is nothing but the stretcher. To carry it for ten or twelve miles is a practical impossibility, unless it is slung as a dooly, when it becomes merely a very inferior dooly.

The long pole litter borne by two mules in Indian file, was found practical, and not uncomfortable, by the Russians in Manchuria, and where a sufficiency of mules or pack horses, or even camels, could be obtained, it might be of great value. At any rate, the choice appears to lie between it and the dooly for transporting helpless sick over a difficult country.

It would be not the least important of the duties of the Special Service Officer mentioned above, to prepare beforehand details of the particular forms of ambulance suited to the different parts of his district, remembering always that the severest fighting is likely to take place in hills and broken ground, rather than in open plains.

Between the Field Ambulance and the rail, or river, a service of motor ambulances would be admirable, if good metalled roads were available. The motor does not get exhausted and eats only when at work, but, alas, it soon shakes itself to pieces over bad roads, and especially so on solid tires. It cannot work over loose sand, mud,

or swampy ground, or ford rivers, and its use in war would be very limited indeed, outside the continent of Europe.

The Advanced Stationary Hospital, immediately behind that newly consolidated unit the "Field Ambulance," will have to partly assume the functions of the old field hospital. It must be pushed well to the front, and will, therefore, be often forced into positions where it will not be permanently needed. Although by regulation equipped for 200 beds, it is, in actual warfare, the most protean of all the field medical units, and must assume practically any size required by the exigencies of the moment. With severe and continued fighting going on in its immediate front, or on the occurrence of an epidemic, it may (especially if at a distance from a line of rail) be rapidly expanded to 400 or 500 beds, and be obliged to undertake, more or less, the continuous treatment of the sick. Should the situation render such a course advisable, it may be formed into a fully equipped general hospital and so become fixed. On the other hand, as its uses pass away, it may shrink to its normal size and finally vanish, to reappear at the new front in its original form. Or it may simply remain where it is and become a line of communication hospital—a "stationary hospital" in reality.

It must be well equipped with surgical instruments and materials, since it must undertake all absolutely necessary operations; and have a large stock of medicines, to allow of rapid increase in the number of its beds; also the officer in charge should have full power both to purchase supplies and employ local labour when required.

The tentage of this hospital should afford good protection, but should not be too heavy. The Hubert tent has been suggested. I have no personal experience of this tent, but the kanats seem too low, and, at the weight, there can hardly be cloth enough in the roofs to afford protection against a really hot sun. The Cabul service mess tent, 18 feet by 12 feet with $4\frac{1}{2}$ feet kanats, weight 400 lbs., is light, easily pitched, and affords excellent protection. Its size could be increased to 20 feet by 16 feet for a weight of about 500 lbs., thus giving the accommodation of the I.P.E.P. tent at about half the weight. Two of these tents pitched end to end, 8 feet apart, with a double roof of cloth slung to a connecting ridge pole between them, would take twenty beds for a total weight of about 1,100 lbs. This would be light enough for a "stationary" and good enough for a "general" hospital.

A bed cot 30 inches wide, with spring bottom, and legs and frame of steel bicycle tubing, legs and head rail to fold flat to

frame, could be made of ample strength at a weight of 21 lbs., and would be well adapted for use in both stationary and general hospitals. All utensils, cooking pots, &c., should be made of aluminium. The first cost would be considerable, but would be saved in transport. Unless the climate is so rigorous as to leave no option, it is not advisable that these hospitals should occupy existing buildings. These are rarely suitable, or sanitary, without more alteration than there is time for, and when a hospital gets into a permanent building it is somehow very hard to get it out again. Each stationary hospital should have permanently attached to it, one ambulance waggon, one general service cart, one light cart, and two water carts. It should also have at least six wheeled stretcher carriages and a large reserve of field doolies.

The object of the General Hospital, at what may now be called the advanced base, is to afford every practical facility for operation, treatment, and nursing, possessed by a first class civil hospital at home, in order to expedite the recovery and return to the fighting force of every possible man in the shortest possible time. If the climate is good, and supplies obtainable, none but the hopelessly broken down or crippled should pass coastwise through this great strainer; all others should be cured and returned to the ranks through convalescent depôts, which should be established as near the front as circumstances permit. The further a sick man is allowed to go to the rear, the harder it is to get him back, and the less relish he has for fighting when he does get back, added to which in going and returning he cumbers the line, which is badly needed for other purposes.

With these objects in view, the use of huts or tents for the wards of this hospital is not a matter for academic discussion, but of climate. In great cold, huts, and double walled huts, or even more substantial buildings, may be a matter of vital necessity. In a heavy jungle country, huts well raised off the ground, as in the Burma military hospitals, will probably be greatly superior to tents, and the materials for them will be at hand. In moderate climates, on clean, open ground, good tents are perhaps preferable to anything else. It is a purely local matter, and must be decided as such, always remembering that this is practically a fixed hospital, and that in its plan and construction, every effort must be made to place its sick under the best hygienic conditions possible. Its *personnel* should at first consist, almost exclusively, of Royal Army Medical Corps officers and men and Army nurses, but as the war progresses and the services of these are required at more advanced hospitals, some

of them may be replaced by civilians. The proportion of the latter should, however, never be allowed to exceed 50 per cent.

The lighting of this hospital should be good. If a dynamo is available electricity is most suitable, but acetylene is portable, easily managed, gives a beautiful light, and in a country where fuel was scarce, and the power to run the dynamo absent, might be used with advantage.

Efficient sterilisers should be provided for drinking water: under the conditions of active service no filter is to be trusted. Also for all excreta. The dry-earth system has been greatly discredited of late years, and the sterilisation only of dejecta which are *known* to be infective is a very partial protection. Even if the dry-earth system was all that was at one time claimed for it, there may be no earth available in many situations.

A laundry should be established, and should be under the entire control of the medical officer in charge. If possible, a railway siding should be run into the hospital. It saves the patients much discomfort, saves transport, labour, and loss of time, and clears the main line of stationary hospital trains, and the main line platforms of doolies, stretchers and waiting bearers. Unless the levels are very bad, such lines are easily laid, as the speed over them need never exceed five or six miles an hour, and the rails need only be spiked to sleepers, not laid in chairs. If this is done, one ambulance waggon, two light carts, and two water carts should be sufficient transport, permanently under orders of the medical officer in charge.

Twenty beds are set aside for officers, and specially dieted. If the hospital be expanded to more than 520 beds, the number of beds for officers must be proportionately increased, but if two or more general hospitals are established near each other it is better to unify this accommodation, and form a separate hospital for officers, in order to simplify dieting and nursing.

It is very important for the treatment of the sick, that the health and good spirits of their attendants should be maintained at the highest level. A gloomy man, however hard working he may be, is a depressing factor in the wards, and the natural irritability consequent on a low state of health due to monotony and unrelieved mental strain, is conducive neither to good discipline nor good nursing. The more highly we educate our men, the more they will feel this strain, and every effort should be made to lighten it as far as possible. Men are far more quickly broken down by petty discomfort and dull unvarying routine than by hard work.

They should be provided with better tentage and more means of recreation when off duty. I have lived in tents of many patterns, and have found the bell-tent, single or double, about the worst possible for any purpose, except perhaps pictorial effect. The double fly E.P. mountain battery tent, 8 feet by 12 feet, weight 80 lbs., would shelter four men in comparative comfort, at a weight of 20 lbs. per man, but they should also have one large recreation tent or hut supplied with chairs, stools and tables, papers, cards and a few simple games, such as draughts, dominoes, &c., and a small bar for mineral waters, tea, &c. They should also be encouraged to play outdoor games, such as rounders, football and quoits. These require little paraphernalia, and an evening game of rounders, in which the junior officers might join, would do much to break the monotony and promote cheerfulness and good feeling, without in any way impairing discipline. Camp fires and sing-songs in which officers, convalescent patients and orderlies join, should also be encouraged.

The nursing sisters should have such games as badminton, deck-quoits and bull, and everyone should be encouraged to do something when off duty, and not lie about thinking of their happy homes and present discomfort.

These suggestions are not intended just to give the staff a good time, but to promote the comfort and welfare of the sick, and are of more real importance than mere outside decoration of the hospital. When every matter relating to hygiene, the treatment and comfort of the sick, and the welfare of their attendants, has been perfected, "finish" is not to be despised, but it should come last, not first. Mere outside show may cover a multitude of sins, and, even if it does not, may place too great a strain on the working powers of the staff. In all things the hospital should be for the sick, and not for the honour and glory of the officer in charge.

At first the treatment of the sick largely devolves on the stationary hospitals on the lines of communication, which are hastily expanded to meet the needs of the moment; but once the advanced general hospitals are in working order, invalids for the coast should be passed straight through, and not from hospital to hospital, and those on the line should be reduced till they are only sufficient for local requirements, their surplus equipment being sent to the front and their civilian employees utilised to the best advantage elsewhere. Ambulance coaches, attached to ordinary trains, will collect the sick, from the smaller guards and posts along the line, into these hospitals. If there should be any

unavoidable break in the journey, such as a transition from rail to river transport, a large hospital must be kept open at this point; and perhaps some, whose position is exceptionally favourable, may be expanded into general hospitals, but there should be no delay in reducing the remainder to actual requirements, and utilising their material elsewhere.

Ambulance trains should be assembled and fitted from rolling stock in use on the system over which they are to run, as, by this means, the weight of the trains can be best adapted to the engines which have to pull them, the condition of the line, and the gradients which will be encountered. This is more satisfactory than the use of large and heavy trains fitted elsewhere, without regard to local requirements. Minor details may vary, but there are some essential conditions which must be fulfilled. The train must be built on, or altered to, the corridor plan, as through communication while in motion is indispensable on long journeys. It must contain a kitchen, pack store, steward's store, and accommodation for medical officers, nursing sisters, and attendants. The number of the latter will, of course, depend on the number of patients which can be carried, and this will be limited by the weight which can be pulled. There must be sufficient facilities for washing, for officers, patients, and orderlies, as well as latrine accommodation, and if more than one day is to be spent on the train baths will be needed. One closet pan and one fixed basin will usually be found in the lavatory at each end of a saloon or corridor carriage. Any carpenter can make and fit rectangular wooden trough baths, and a plank fitting over the top of these will support two hand basins on each. These will be found far superior to canvas baths, which soon get very foul. A light blind of cotton drill, to lower over the bath and prevent splash, is easily fitted, and is well worth the trouble. It need not be waterproof. Water tanks should be fitted to all carriages, with hose connections, so that the whole system can be filled from one opening at either end of the train. A small dispensary should be fitted. It need not be much larger than an American roll top desk, but will be far more convenient than an outfit of "Field Companions." Part of the front should let down to form a dispensing table.

Saving of weight means increase of carrying power, and perhaps the possibility of adding an extra carriage to the train, and therefore, heavy iron fittings, such as are required for holding berths, are to be avoided, and light wood and canvas fixed berths used instead. The cooking range, especially, should be light. If made of good material there is no reason whatever why it should

be ponderous. The choice of a light in place of a heavy wood for shelves and fittings will make a great difference in the aggregate.

It may be necessary to utilise the carrying power of the train to the full, but if about ninety patients can be carried and an additional spare coach added to serve as a dining and sitting room for convalescents, it will be a great relief on long journeys, especially in a hot climate.

In calculating weights it must not be forgotten that it is the loaded train which must be taken.

As to the order of arrangement, it is important that the kitchen should be next the staff quarters, and the convalescent enteric cases placed at the other end of the train. It may seem a small point, but it is cruel to carry savoury dishes past hungry men who may not touch them, or to tantalise them with the smell of cooking.

Too much room should not be occupied by the staff quarters. The medical officers are far better off in any case than their brethren at the front, and excess of space devoted to their comfort means so much less for someone else. The Royal Army Medical Corps rank and file will be the probable sufferers.

A large supply of disinfectants should be carried and all excreta sterilised, special receptacles being fitted under the closets, and the contents emptied and dealt with, at regular stopping places, by a special sanitary staff. The use of izal and dry-earth in the pans would render the contents inoffensive and fairly safe.

River passenger steamers require little alteration to fit them for ambulance purposes, and on most navigable rivers they can tow two large flats or barges, lashed side by side, at a fair pace down stream. These latter, fitted with awnings, wood and canvas bunks, and divided by canvas screens into kitchens, wards, convalescent deck, orderlies' quarters, and quarters for the nursing sisters and medical officer on duty, with pack store and steward's store on the lower deck, can be made to carry a number of sick in great comfort. It is well to have two nursing sisters and one medical officer always on duty on the flats, and one medical officer with one or two nursing sisters on the steamer.

River steamer captains always tie to the bank at night. In a malarial climate this should be strictly forbidden, as the banks, especially near high grass, usually swarm with mosquitoes, while the stream is comparatively free from them. Convalescent officers will clamour for an evening walk, and, unless the captain of the boat has strict orders from high authority on the subject, he will tie up to save the trouble of anchoring, in which case much

avoidable fever will result. Every boat ambulance and every hospital train should, if the journey is more than twelve hours long, carry one washerman, and be provided with a small bunk for washing accidentally soiled clothing in.

When the advancing force leaves the line of rail or river, stationary hospitals must be established behind it at comparatively short intervals. Wherever a post is established to guard communications, it will usually be advisable to put a stationary hospital or a section thereof, and between these to form a convoy rest camp every ten or twelve miles, should the state of the country admit of it. These should be equipped with dooly or stretcher-beds, or locally purchased cots, as it is very hard for sick men to spend the night upon the ground after what, to them, is an exhausting journey. They should hold a good supply of medical comforts, and a small stock of medicines and surgical materials. Their sanitation and water supply should be most carefully arranged and supervised. They require a supply of fodder, and special arrangements for watering transport animals. Definite lines for the latter should be marked out, and a separate camp for their attendants established in a suitable situation a little apart from the hospital camp, and rules must be laid down for the thorough cleaning of the camps and lines immediately after the departure of each convoy. Each camp should have a staff of at least three men, one of whom should be able to cook. A St. John's or Volunteer Ambulance man might be placed in charge, with a civilian cook and orderly under him. They should have a good supply of effective lamps. Convoys often arrive just at, or after, dark, and want of light causes some confusion and difficulty in feeding the sick, dispensing, adjusting necessary dressings, and settling down for the night. The practice of placing a solitary man in charge of these lonely posts, as has often been done in former wars, is cruel, and leads to insanity and crime. They should be frequently inspected, and a firm check should be kept on the consumption of comforts, especially liquors. The orderly in charge should be made to keep a book like Army Book 188, and enter in it the quantities issued to each convoy. The convoy officer should sign both foil and counterfoil, and take the former with him to be handed in at the stationary hospital. Here the quantities would be entered in a "Convoy Camp Book" (fig. 5), kept in columns, under the name of the camp, and the foil filed. This would involve but little clerical labour, and would provide the stationary hospital and inspecting officers with a ready check on the comforts issued to, and used by, each camp.

The inspecting officer should not only note that the camp is thoroughly well kept in every respect by the men in charge, but should encourage them to improve its appearance, by paths and gardens, and extra smartness, as all this occupies them and keeps them fit; but, however they make work, they will still have much spare time and many weary, monotonous hours to get through, and they should, as far as possible, be supplied with magazines, papers, cards, draughts, or dominoes, string for netting, wool for knitting, or a few hooks and some line if there is a river or lake near, or the care of a few milch cows, goats, or fowls—anything to keep them from lying about all day smoking and longing for a drink. The inspecting officer should make it a part of his duty to find out what these isolated men need, and do all in his power to supply it.

FIG. 5.—Specimen Page of Convoy Camp Expense Book.

CAMP — AMBIGOL.										
Date	Ext. carnis oz.	Soup Tins	Milk Tins	Rice oz.	Arrowroot oz.	Cocoa oz.	Sugar oz.	Port wine oz.	Brandy oz.	Name of convoy officer
Totals brought up										
Total ..										

To be kept up at the Stationary Hospital from foils of Army Book 188 brought in by Medical Officers in charge of Convoys.

I once, in an emergency, voluntarily took charge of such a camp for three days, and although there was a good deal to be done in putting things straight, got some idea of what the life was like. There was not a scrap of printed matter in camp, or any human being, black or white, nearer than ten miles. My predecessor had been removed, a raving maniac, after five weeks of it. My successor was brought off a few weeks later suffering from delirium tremens—two men and a quantity of good liquor wasted through want of ordinary precaution and humanity.

In addition to stationary hospitals and rest camps, it will be necessary to push forward large hospitals, equal in size, and, as far

as possible, in comfort and practical facilities for treatment of the sick, to general hospitals, but with less cumbersome equipment. These hospitals will be necessary, because acute cases and wounded cannot be sent the long convoy journey to the railway, and, therefore, accommodation for at least 10 per cent. of the force must be provided immediately in rear of it. In order to secure the two requisites of mobility and comfort, every ounce of unnecessary weight must be pruned away.

The modified Cabul service mess tents, pitched in pairs, as suggested, could be made to hold twenty-four cots with 18 inches space between each, at a weight of about 46 lbs. per cot, or, if the climate admitted of the outer fly being left, at about 34 lbs. A strong cot, 6 feet 3 inches by 2 feet 6 inches by 1 foot high, with head rail and legs folding flat, could be made with a frame of $1\frac{1}{4}$ inch 16-gauge bicycle steel tubing, and a bottom of steel spring wire or canvas, at a weight of 21 lbs., or possibly a little less. This, with a 12-lb. mattress, a 3-lb. coir and a $1\frac{1}{2}$ -lb. feather pillow, two blankets and sheets, would give a total weight of tentage and bed and bedding per patient of 96 lbs. with the double, or 84 lbs. with the single fly. Pyjama suits would be required, which, with reserve for changing, would add about 4 lbs. per patient.

All possible utensils, cooking and others, should be made of aluminium, or aluminium alloy. It would be, like the cots, expensive, but a good mobile hospital of this size and class can never be cheap, and it would save its cost in transport just when transport was most valuable.

The cooking range must be left behind. It is impossible to drag around a couple of tons or so of metal for this purpose when the troops are possibly on short rations for want of transport. Our men should be taught to cook over the small Indian "chula," which can be constructed anywhere, and burns little fuel. The service camp kitchens are very wasteful in this respect. There is no need to copy the insanitary features of Indian cookery, but only the production of well-cooked, palatable dishes, with very simple apparatus, and the expenditure of little fuel; for the man who cannot prepare palatable food without an elaborate kitchen range may be a perfect Soyer at home or at the base, but is simply a useless inefficient at the front. We are teaching our men to cook better, but I fear that we are also teaching them that they cannot cook at all without an elaborate and cumbrous apparatus.

Good lighting is very necessary. It is not probable that electricity would be available for either this or for stationary hospitals

off the line of rail. Acetylene lamps with a separate generator for each, so as to avoid a burdensome installation of tubing, would answer admirably, and the fuel is light and portable, while paraffin is obtainable in most countries, and no doubt the lamp makers could meet our requirements if clearly specified; witness the powerful "sun" lamps which throw the whole light downwards, and the motor lamps which give a steady light in the strongest winds.

Four ambulance waggons, two general service waggons, two light carts, and four water carts, with horses and drivers, should be permanently under the orders of the medical officer in charge. The hospital should also hold some wheeled stretcher carriages and a large reserve of doolies.

All sick and wounded able to travel, and likely to require prolonged treatment, should be passed to the rear whenever possible. Slighter cases should be treated and returned to duty, and severe cases, unfit for removal, must perforce remain.

As the force moves on, the advance line of communication hospitals will be thrown forward, and the light general hospital will be cleared of sick as fast as possible, ready for a further advance; in the meantime, a similar hospital must be pushed forward to take its place when required. The whole *personnel* of these light general hospitals should be Royal Army Medical Corps, with the exception, perhaps, of one consulting surgeon, as the officer in charge of it has no time to instruct civilians in their duties.

As the war proceeds, and the country behind, which has been swept by the advance of large armies, settles down, it will usually be convenient to divide it up into districts, and carry on its medical administration on the ordinary lines of a British possession.

War between civilised nations is usually decided by a succession of heavy battles between regular troops; but occasionally a brave people will rise and continue a guerilla warfare after the defeat of the regular armies, while, in savage war, the whole male population is under arms, and, in both cases, away from lines of rail or river, communication is only open to armed parties of sufficient strength, and, under these circumstances, the conditions under which medical aid can be rendered differ materially from those hitherto described. Usually a river or line of rail, or the main trade centres, have been seized and are held in force, and at these "General" or "Stationary" hospitals are established, according to requirements. From these primary posts, armed columns are despatched in various directions through the surrounding hostile country to seize subsidiary points of vantage, follow up and crush organised bodies of the

enemy, and pave the way for civil rule with the aid of an armed police. The guerilla, unable to meet regular troops in the open, betakes himself to mountain, wooded or marshy fastnesses, where wheeled transport, as a rule, is useless, and under these difficult conditions all sick, wounded or dying must be carried forward with the column, and there can be no such thing as a man "too ill to be moved." Those able to sit up must be carried on ponies, mule or camel cacolets, or elephants, and the remainder in doolies. The country is usually far too steep and broken, or the forests too dense, for animal-borne litters of any kind, and the whole transport of such a column must be prepared for the worst ground it may have to meet; no half-way chance is possible. The stretcher is useless, for the sick must be carried for anything between ten or eighteen miles a day at the pace of the marching troops, whose efficiency must not be impaired by delay on account of their ineffectives, and to fall out means death (probably by torture) for sick and bearers alike. Indeed, the light dooly is as far in advance of the stretcher as a method for transport of wounded, as the Lee-Metford is of the flintlock as a weapon of offence, and doolies, in the proportion of 10 per cent. of the strength, should accompany such a column.

If tents can be carried at all, the I.P. Mountain Battery tent is the best, with a single fly tent like the Elgin Mills "Light Bath Tent," but 8 feet square, for operating.

The medical and surgical equipment will be arranged according to the strength of the column and the probable duration of the expedition. The medical officer in charge should have power of purchasing supplies, such as fowls, eggs, milk, meal, rice, &c., for use of the sick. However otherwise employed throughout the day, he should arrive at the spot chosen for the halt with the advance guard, and at once take measures for the protection of the water supply, and assist in arranging the bivouac to the best sanitary advantage, as far as military exigencies permit. When his sick arrive, he will see them placed in such temporary shelter as may be available, and their immediate wants attended to pending the erection of the tents, the preparation of existing buildings, or the erection of brushwood or thatched shelters. In most cases, comfortable beds of brushwood covered with straw or dry grass or leaves can be arranged for the lighter cases. It is wonderful what can be done in this direction in the most inhospitable places, if the medical officer attends to it himself. It is usually better to make up such beds as described rather than use

native cots, as these are apt to swarm with vermin. As soon as the sick are installed in their tents or shelters they must be fed, after which the medical officer had better get his own food before doing the necessary dressings, seeing fresh sick and performing operations.

Each medical officer in charge of such a column should be supplied with four good lamps, which will not blow out under any conditions. This is of vital importance, as serious operations may have to be performed after dark.

Advantage must be taken of every court proceeding to an established post to get rid of all sick and wounded who are able to travel, with the exception of such cases as will be fit for duty within a few days.

At all the large garrisons, stationary hospitals should be held in readiness, and sections of them despatched to each military post established by the flying columns as soon as escort is available. The medical officers in charge of troops will then be able to discharge their sick into these at intervals, and they will transfer to the larger hospitals as communications become more open.

I have purposely omitted to go into the details of the fitting and arrangements of sick transports and hospital ships, as I have had little personal experience with them, and opinions formed from mere reading could have no practical value.

In conclusion, I wish to mention a precaution against malarial fever which, during four years civil work in Upper Burmah, I, personally, found of the greatest value. I allude to the inunction of the exposed parts of the body with aromatic oils, which prevent, or at least discourage, the attacks of mosquitoes. My work took me at all seasons of the year into jungles which were simply poisonous with malaria, and all the leave I could obtain was spent in pursuit of big game, which invariably frequents the most malarious localities, and, although by no means immune naturally, the only attack I got was once when, having forgotten my oil, I was out for two nights. On one occasion, out of a party of eleven, although all had mosquito curtains, two who used the oil alone escaped fever, and I could multiply instances of its value *ad infinitum*.

Now, while other diseases may cause a larger mortality, none so fatally reduces the fighting efficiency of a force as malarial fever. The Durham Light Infantry were so weakened by this disease that they were unable even to furnish their own baggage guards to the railway station when they left Mandalay in 1901.

We have proved that the cause of the fever is the bite of the Anopheles, and, so far as troops in the field are concerned, we stop dead short and leave it at that. Now there are three ways in which we can attempt to prevent it:—

(1) Extermination of the insect, which is impracticable on service.

(2) Mechanical protection of each individual by means of mosquito netting, &c., probably impracticable on service, although the Egyptian Army furnishes their black troops with this protection. It is, at any rate, very imperfect, for the mosquito by no means confines her operations to night time. In Burmese forests, at any rate, she is very much in evidence all day, and by 5 p.m. is well on the wing, and extremely hungry. Neither the soldier nor sportsman can avoid her by the simple use of nets at night.

(3) Protection by means of some aromatic, astringent or bitter substance, applied directly to the skin where uncovered by clothing. This is effective at all times, and is practicable in the field. Its application may be difficult, but there is no other way. The principal objections to it are:—(a) That we have not yet discovered an absolutely protective application. This is only a reason for turning our serious attention to a really important subject; (b) that the men could not be got to use it if provided. This is a matter of discipline, and could and would be enforced, once its value was placed beyond dispute, and here we have the whole-souled assistance of the mosquito herself, who is such an unmitigated nuisance that the most casual are glad to get rid of her; (c) expense and difficulty of transport of a large quantity of the substance used. I can only say that anything that would keep men fit to fight is worth its weight in ammunition, for men are, after all, the most expensive items in the field. The subject is too serious to be set aside by frivolous objections, and the loss to a fighting force is not represented merely by its men in hospital, for every infected man is liable to go down with fever just when most needed. A night march, the fording of a river, the chill of the dawn when fallen in for the attack on some position, and they go down in dozens.

Many other diseases besides malaria have been traced to the bites of various insects, and the subject of protection is becoming a pressing one, if any practical good to the health of our troops on service is to result from the scientific research which has been so ably carried on of late years by officers of the Army, Navy, and Indian Medical Services.

REPORTS OF THE COMMISSION APPOINTED BY THE
ADMIRALTY, THE WAR OFFICE, AND THE CIVIL
GOVERNMENT OF MALTA, FOR THE INVESTIGA-
TION OF MEDITERRANEAN FEVER, UNDER THE
SUPERVISION OF AN ADVISORY COMMITTEE OF
THE ROYAL SOCIETY.

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(Continued from p. 440.)

REPORT ON THE PREVALENCE OF MEDITERRANEAN FEVER
AMONGST BRITISH TROOPS IN MALTA, 1905.

BY LIEUTENANT-COLONEL A. M. DAVIES.

Royal Army Medical Corps ; Member of the Mediterranean Fever Commission.

(b) *Latrine Air*.—The condition of the latrines in the different barracks in Malta is, in many cases, extremely unsatisfactory, the cause generally being an inadequate water supply. The type of latrine in general use is the “Jennings’ continuous pipe latrine,” which is a good pattern, and, when properly used, quite free from offence. The dry-earth system is still in use in some barracks. At Lower St. Elmo new water-closets were fitted up in the early part of 1905, with improved siphonic flushing arrangements; although these arrangements are susceptible of further improvement the latrines, both upstairs and downstairs, have been kept in a sanitary condition without difficulty, and the water supply has been ample throughout the year.

At St. Andrew’s Barracks, only recently completed, the latrines are new and of good pattern, and the water supply has been, so far, ample. At Fort Ricasoli, and at Valletta, Cottonera, Forrest, Imtarfa, Citta Vecchia and Gozo hospitals, the water supply has been sufficient, and the latrines kept in good order.

Throughout the rest of the barracks the latrines have not, speaking generally, been kept in a satisfactory condition. In the various barracks that make up the Cottonera Lines the supply of water for flushing has habitually been inadequate; indeed, it has often been altogether cut off, so that the latrine pans have been allowed to become partially dry, excreta remaining in the pans and fouling the sides, and in this way gradually drying up and becoming scattered about as dust; this occurred at Polverista, St. Paul’s Bastion, Vittoriosa, and elsewhere. At Upper St. Elmo, St. James

Cavalier, Floriana Old Barracks, and Verdala, the water supply has been scanty, and the flushing not done often enough ; consequently the latrines have habitually, or frequently, been over-full ; in which case, when they are emptied, there is a likelihood of excreta remaining on the sides of the latrine to a greater or less extent, and eventually becoming dried and disseminated as dust. At Tigne a new latrine has quite recently been opened ; at present it is in good order and quite clean. Tigne (until July, 1905), Manoel, Pembroke Fort, Imtarfa, Gozo, and all the outlying forts and encampments (except Fort Rinella and Camp Mellieha) have had the dry-earth system of removal ; the removal is effected once only in the twenty-four hours, very early in the morning, about 3 or 4 a.m. As the greatest use of the latrines takes place between 8 and 10 a.m., it follows that the excreta are retained in the lines for from sixteen to eighteen hours every day, instead of being removed at the earliest possible moment. If the application of the dry-earth were immediate and thorough, this retention of foul matter might perhaps be harmless, or even inoffensive. As a matter of fact, it is very seldom the case that the system is properly carried out, and the net result is that dry-earth latrines are generally in a filthy and insanitary condition for, at any rate, many hours of the day and night. All the latrines on this system in Malta (with very few exceptions) have been habitually in a foul state. Fort Rinella and Camp Mellieha have a water system of removal, with a good supply of water. Fort Ta Silch has had a dry-earth latrine for night use (which has also been habitually used during the day), and a temporary trench-system just outside the fort ; this arrangement has been very unsatisfactory.

The only barracks that can be considered to have been free from the effluvia of fæcal matter are those first mentioned, viz., Lower St. Elmo, Ricasoli, and St. Andrew's ; also Fort Rinella and Camp Mellieha ; in all the others persons using the latrines have, during a great part of the day, been subject to whatever risks may be considered to arise from breathing air contaminated with fæcal emanations, that is, effluvia from excreta in a more or less fresh condition. All the hospitals have been free from this risk. The case as regards Mediterranean fever in these barracks, is that the occupants of Lower St. Elmo have suffered more than those of any other barracks, and the occupants of St. Andrew's to about an equal extent with those of most of the barracks (see Table I.) ; Ricasoli has suffered but slightly. The hospital population has suffered considerably, but this can hardly have been on account of the state of

the latrines, which have been maintained in a satisfactory condition throughout the island.

In the two barracks that have suffered least, although in Ricasoli the latrine air has been free from faecal emanations, in Verdala the reverse has been the case; while of two barracks lying alongside of each other, and similar in situation and general construction, St. Andrew's, with quite new latrines well flushed, has suffered more than St. George's, with scantily-flushed latrines, many of which have been in existence for a long time, and have therefore become proportionately foul.

There does not appear, therefore, to be any definite evidence connecting the incidence of Mediterranean fever with the presence of faecal emanations, as far as concerns the troops, during the period under review.

As regards married families, the principal Married Quarters—Camerata, Tigne, Old and New Floriana, New Verdala, St. Nicholas, Ricasoli and St. Andrew's—are provided with water-closets of excellent pattern, and are quite free from any kind of drain or latrine emanations. This cannot be said of the older quarters, such as St. Nicholas Back, and the old St. George's blocks, where latrines of old pattern are still in use; nor of the hired quarters in Strada Magazzini, Floriana, which have been already alluded to. Although a few cases have occurred in the latter quarters, most of the women and children attacked have lived in the newer quarters (such as New Floriana), which are provided with water-closet chambers and fittings of the best and most modern kind. Such cases cannot be regarded as due to infection through "faecal emanations."

(c) *Urinal Air*.—The recent researches as to the viability of *M. melitensis* in dust, and the demonstration that Mediterranean fever can be communicated to goats (though not, so far, to monkeys), by feeding them on dust infected with the urine of Mediterranean fever patients, make it necessary to examine into the condition of barracks in regard to the presence or absence of urinary contamination of the air. Throughout the island the barrack urinals are constructed on the same general plan, viz., ranges of partitioned stalls made of slate, flushed with water from a sparge pipe, the flow being carried direct into the nearest drain. It has been for some years the custom to cover the slate surface with tar from time to time, a result of which has been that the surfaces have generally become rough and uneven, leading to collections of urinary sediment all over the lower part. The water

flushing has also been quite inadequate to keep the stalls clean ; this has been partly due to an insufficient quantity of water being used, and partly to its being inefficiently applied, the holes of the sparge pipes being very generally blocked up, or the pipes themselves being fixed in a wrong position. The consequence has been that barrack urinals have generally been dirty and ill-smelling. During the past year a new arrangement has been brought into use, according to which the water flushing is omitted, and in its place the urinal surface is coated over with a mixture of kerosine oil and lampblack or tar. The best application for the purpose is a substance called "heavy oil," but, as this has apparently not been procurable in Malta, various substitutes have been used in its stead ; a mixture of colza oil and tar in equal parts, as used at Imtarfa, appeared to me to be the most effectual, and needed only to be applied once a week. No deposit takes place on the back of the stall, and there is not the least offensive smell. Elsewhere, results have not been so satisfactory. But when this, or some similar application, is used effectively, the urinals are undoubtedly cleaner than under the old arrangements. Although water must not be distributed over the surfaces to which the oil or tar has been applied, it is necessary to flush the *drain* with water, and to wash down the floor of the urinal frequently, otherwise the floor and the drain will become foul. This is what has occurred in practically every urinal in every barrack throughout the island ; urine has been allowed to dry on the floor, and so become converted into dust and pollute the air.

With the knowledge that we now have that Mediterranean fever often occurs in an ambulant and unrecognised form, there is little doubt that infective urine has been widely distributed throughout barracks in this way. On the other hand, it has been shown that exposure to direct sunlight destroys the specific organism in a few hours (Horrocks). In some barracks, as in Upper and Lower St. Elmo, the old barracks and bastions in Cottonera Lines, Verdala, St. Francis, Marsamuscetto, Old Laboratory, the old part of Floriana, and in the detached Forts, the urinals are under cover and shielded from the direct rays of the sun. This is also the case in all the hospitals. Under such circumstances *M. melitensis* might live for several days, as Horrocks has found that it will survive for twenty-eight days in ordinary street dust, and in "building dust." In the newer barracks, such as Tigne, New Floriana, St. George's, St. Andrew's and Imtarfa, also at Manoel, Ricasoli, Gozo, and, of course, in all the camps, the urinals are out

in the open, without covering of any kind. The duration of infectivity of the dried urine would appear in these places to be very short, indeed, almost negligible. It is certainly the case that the places which have suffered most, viz., Valletta and Cottonera Hospitals, Lower and Upper St. Elmo Barracks, have urinals that would retain infectivity longer than such barracks as Ricasoli, St. George's, and Imtarfa, that have suffered comparatively slightly. Also Floriana New Barracks have had fewer cases proportionately than the *Old* buildings. But in the case of the two hospitals named much more care has been taken than in barracks generally to keep the floors of urinals clean, and in these places I do not think any appreciable risk of infection can have been incurred in this way. St. George's and St. Andrew's are identical in this particular respect, but have suffered differently; and Verdala, which has fared better than any other barrack but Ricasoli, has urinals as dark, and almost as confined, as in any barrack. While there can be no doubt that every care ought to be taken to prevent fouling of the ground with urine, and to cleanse it frequently, when fouled it can hardly be said that the fouling which has occurred affords any satisfactory explanation of the distribution of the disease during the recent epidemic.

There is another way, however, in which urinary infection may have been spread. None of the barracks in Malta are provided with night urinals. In every case the urine tub is still in use. In the older barracks it is placed on the floor outside the barrack-room door in the verandah or passage. In the newer barracks a special stand is provided. At Tigne New Barracks, St. Andrew's, and the new blocks at St. George's, the tubs are placed in an alcove behind the barrack-room, and, on the upper floor, have to be brought *through* the room, in order to be taken downstairs to be emptied.¹ It must often happen that urine gets splashed about on the floors. It is conceivable that infection might be spread in this way, and that the admission rate from these new, and in most respects sanitary, barracks has been raised from this cause.

Although *M. melitensis* can survive in dried dust for about a month, and it has been found possible to infect goats by feeding them on such infected dust, experimental infection by inhalation has not been fully demonstrated in regard to monkeys. In Part I. of these Reports Horrocks detailed two experiments which indicated that "*M. melitensis*, when present in dry dust, is

¹ It is probable that the same thing happens, though it is not necessary, on the lower floor, in order to save trouble.

capable of being absorbed by monkeys"; but in the account of further experiments in Part IV., the same observer stated that it had "not been found possible to infect monkeys with dust polluted with urine from Mediterranean fever patients and then thoroughly dried. Goats, however, can be infected in this manner." As the enormous doses of strongly infected dust employed in these experiments are only occasionally capable of transmitting the disease, the probability of there being any habitual pathogenic property in the dust of urinals or rooms contaminated in the manner just mentioned, appears to be very remote. The possibility, however, cannot be disregarded; and although the *quantity* of the *contagium* may have been minute at any one point of time, it is likely that it has been constantly present in such places as Lower St. Elmo.

(d) The habits of the bulk of the Maltese population, as in Southern Europe generally, bring about a fouling of the ground with fæcal and urinary excreta. The offices of nature are performed not only in private, but in public, places, advantage being taken of every nook and corner that offers. Around the barracks that are situated in the old fortifications there are so many ditches and secluded spots that the whole neighbourhood is sometimes a latrine; even within barrack limits it is often impossible to prevent this fouling of the ground by the native population. Floriana Barracks (including Notre Dame, Ravelin and the intermediate ground) and Verdala, also all the Cottonera Lines, are instances in point. Outside Lower St. Elmo on the shore of the harbour, and in the Jews' Sallyport, the condition of the ground is particularly filthy. Wherever building operations are being carried on, as has been the case between Porta Reale and Floriana Barracks during the past year, the fouling of the ground is also extreme. On one morning I counted thirteen separate *dejecta* immediately outside the northern end of Floriana Barracks. It may be said that wherever troops are quartered in or near native towns or villages this fouling occurs in the immediate vicinity of their dwellings. Where they are removed from this undesirable propinquity it does not exist, as, for instance, at Manoel, Tigne, Ricasoli, Imtarfa, Gozo. The civil authorities seem powerless to put a stop to this nuisance; and, of course, the military have no control over ground outside barracks.¹ However, insanitary and disgusting as this con-

¹ There is, I believe, one exception to this. I was informed that the troops occupying Lower St. Elmo are charged with the duty of keeping clean the Jews' Sallyport, which is used as a latrine by the natives of the neighbourhood.

dition is, it is not easy to prove any bad effects resulting from it in regard to Malta fever, in view of the strong disinfectant action of sunlight that has been already mentioned. Only in such places (like the Jews' Sallyport), that are covered in, would the specific micro-organism retain its vitality for any considerable length of time. So also in the streets generally, though many corners are fouled, it may be assumed that the virulence of *M. melitensis* is soon destroyed by exposure to the sun. In the fields human excrement is frequently used as manure. Horrocks has found that *M. melitensis* may survive for twenty days in manured garden soil in the laboratory; but in the open fields, fully exposed to the sun, this would only be possible at some distance below the surface, from which situation it would not be likely to be dispersed about in the air, and inhaled or swallowed by any passer-by.

The air of the streets of Valletta and other Maltese towns is, however, polluted from another source, viz., from the underground cellars, or basements, often used as dwellings, and in which there are often water-closets of the most defective kind. These closets are very scantily flushed with water, which has to be fetched by hand for the purpose, and, supposing any inmate of the basement dwelling is suffering from Mediterranean fever, must undoubtedly be a source of danger to the other occupants, and not only to the occupants, but to the passers-by in the streets above. The effluvia that rise from these basements are often very offensive, and obviously excrementitious; as these places are dark, and never penetrated by the sun's rays, there is no reason to suppose that *M. melitensis* would lose its virulence in a hurry in such a situation. Alternations of temperature cause currents, upwards and downwards, from these basements; and it is within everyone's experience that the current upwards is sometimes (like the effluvium) of considerable strength, and quite able to carry up micro-organisms from the closet below to the street above. In this way the men occupying barracks such as Upper and Lower St. Elmo, which cannot be approached except by passing along streets having basement dwellings of this kind, are more liable to aerial infection than the occupants of barracks, such as those at Pembroke and Imtarfa, situated away from such streets and dwellings.

(e) In the late Captain Hughes' treatise on Malta Fever there is a strong body of evidence in regard to the association of fever outbreaks with "insanitation"; implying by this, contamination of the air of the barrack or dwelling with emanations from drains, cesspits, &c., or putrefying organic matter, or polluted soil. Fifteen

separate outbreaks, of greater or less extent, are carefully described, in which the connexion certainly appears to be one of cause and effect. I made particular enquiry of one hundred and eighty-seven patients suffering from the disease, as to whether they had been conscious of any insanitary condition, or "bad smell," in or near their quarters, which might seem to be connected with their illness. The information gained was disappointingly meagre. In only six cases was there any idea, from the patients' side, of any connexion between "bad smells" and their illness. In one case a w.c. in the officers' mess, where the man was employed, had been frequently stopped up and offensive. In two cases the regimental latrines sometimes became choked, and the men had to clear them, which was a disagreeable job. A man employed at the officers' mess in the Inquisitors' Palace slept on the ground floor, where there were often bad drain smells.¹ One man (and one only) complained of the bad state of the latrines in Cottonera Lines. One sergeant complained of a bad smell in his "bunk," which was very imperfectly ventilated (Lower St. Elmo). This testimony is of very slight importance one way or the other; all one can say is that there does not appear to have been any notable or widespread offensiveness in any of the barracks sufficient to excite attention. This is, after all, what one would expect *in barracks*, where the dwelling rooms are quite disconnected from the latrines and drainage. Only in the old fortress barracks, and in hospitals, are these conditions reversed. But during the last ten years very great improvements have been made in the condition of these old barracks, and the insanitary conditions detailed by Hughes are not, to the best of my belief, now existing in any quarters occupied by troops in Malta. The evidence collected by him is, in my opinion, strongly in favour of a causal connexion between Mediterranean fever outbreaks, and the laying on of excrementally polluted air to dwelling rooms; but I have not been able to gather any similar evidence that would in any way explain the incidence of the disease during the past year amongst the troops.

§ 6.

Having reviewed the influence of water, food and air as channels of infection in Mediterranean fever, with on the whole a negative result, that is, without having succeeded in tracing any definite relationship between its mode of prevalence amongst the troops and

¹ This quarter (and the mess building) was evacuated shortly afterwards. When I examined it I could find no defect in the drainage arrangements.

the existence of conditions pointing to probable infectivity of these media, we are now led to the consideration of what appear to be the only other alternatives, viz., direct or semi-direct contagion, and the agency of some biting insect.

As to direct contagion, Hughes, writing in 1897, dismisses the question very shortly. "Patients suffering from other diseases, occupying beds next to cases of undulant fever, do not develop this fever, nor do the military sick attendants in fever wards suffer more from this fever than those working in other wards, or so much as soldiers in many of the barracks in Malta who have not entered the hospital previous to the onset of their attacks."

The following table is extracted from a paper by Captain J. C. Kennedy,¹ and shows the prevalence of Malta fever amongst patients and orderlies at Valletta Hospital, as compared with the garrison in Valletta, for the years 1897—1904. The figures are ratios per 1,000:—

	Valletta Garrison	Valletta Hospital patients ²	Valletta Hospital orderlies
1897	42·11	11·05	80
1898	22·78	29·99	163·63
1899	22·54	32	34·48
1900	26·68	6·44	54·05
1901	43·11	45·75	121·21
1902	16·90	34·18	48·78
1903	67·31	24·53	50
1904	45·42	14·43	169·23
Average ..	36·23	24·79	92·4

Captain Kennedy points out that venereal patients, and patients suffering from injuries, were much more liable to contract the disease than others, the ratio being 3·31 per 1,000 venereal admissions, 2·42 per 1,000 admissions for injury, and only 0·76 per 1,000 admissions for all other diseases. He explains this by the facts that these patients spend a longer time in hospital, on the average, than any others (except Malta fever), and that they are all treated in one ward, 20B, which is in communication with, indeed, is part of the same room as, other wards containing Malta fever patients. In 1905, 11 cases have apparently been contracted in Valletta Hospital,

¹ JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, May, 1905.

² Cases that have been diagnosed as Malta fever within twenty days after admission, and cases that have been changed from simple continued fever to Malta fever after admission, have been excluded. Also cases that have been admitted from outside, but which may have contracted the disease inside, hospital are not included.

of which 8 were staying in 20B Ward and 2 in 20A Ward; the ward in which the remaining case stayed is doubtful. At Cottonera 10 cases apparently contracted the infection, of which 3 were inmates of wards in which the fever cases were treated. As regards orderlies, Kennedy states that of the 11 who contracted the disease at Valletta in 1904, 8 were doing duty in 20A, 20C, and 37 wards, containing Malta fever patients. In 1905, of the 19 at Valletta who were attacked, 11 were employed in the fever wards. At Cottonera 5 out of 7 cases amongst orderlies were similarly employed, as were the two cases of R.A.M.C. at Citta Vecchia.

Now, leaving on one side for a moment the case of the orderlies, who are exposed to various possible sources of infection, what is the most probable explanation of the occurrence of these cases of infection in patients who are confined to the hospital precincts, and in some instances to their beds? At both Valletta and Cottonera Hospitals the drinking water is above suspicion, the milk has been "pasteurised" since the middle of 1904, and the wards are absolutely free from any kind of contamination from sewer air, or latrine air, or urinal air. Whatever the sanitary shortcomings of the "Long Ward" in Valletta Hospital may be, it is certainly not exposed to any danger of this kind; neither are the other wards in this hospital, nor any of those at Cottonera. Of course, patients who are able to get up make use of the latrines and urinals of the hospital; but in neither of these hospitals has there been any failure in the water supply to latrines, leading to insufficient flushing, nor has there been any reason, even the slightest, to suspect that drain effluvia gain access to the latrine or closet chamber. The latrine for 20B Ward is certainly old and defective, and a considerable waste of water results on account of the defective fittings; also the latrine and urinal for No. 37 has a rough floor, which requires concreting. But though these conditions are insanitary and undesirable, they cannot be reasonably held to be causative of Mediterranean fever.

The condition that appears to be the most probably effective in the causation of these hospital cases is the presence in the wards of a large quantity of disease-producing material in the bodies of the patients themselves. It is known that the specific organism is present in the blood, and is excreted in the urine; it is possibly excreted in fæces, but up to the present has not been demonstrated in the breath, saliva, or perspiration. Transmission by direct contagion is therefore not theoretically probable; by indirect or semi-direct contagion through clothing soiled with excretal discharges

it is not improbable in the nature of the case, although hitherto there has been no proof of this mode of spread. The position, however, is not unlike that of enteric fever, which is now considered (in fact, may be said to have been proved) to be spread by means of "contact," *i.e.*, close association. Presumably this happens by infective urine or faecal matter fouling the skin or clothing of the patient, and then becoming disseminated through the air, and inhaled; or finding its way into articles of food or drink and being swallowed. We have the authority of Koch for the opinion that transmission of enteric in this way is its most important mode of propagation. A few years ago this would have been considered most unlikely, but proofs have been accumulating. I do not see that there is any essential difference between the position as regards enteric fever transmission and Mediterranean fever transmission. Where there is a large quantity of the infective material accumulated in one place, *i.e.*, in a hospital, there the likelihood of its spread is the greater. That this spread occurs but very seldom is because the obvious precautions usually taken are sufficient; but when the number of cases (*i.e.*, quantity of specific poison present) is largely increased, it may probably happen that the precautions are not increased *pari passu*, because the labour involved increases out of all proportion to the working power present. A patient severely ill may pass involuntary evacuations twice or three times in the night. There may be (and have been) two or more such cases in the same ward; obviously the risk of dissemination of infective particles becomes much increased when this occurs. Even with the best methods of disinfection in every detail, of the person, of the clothes, of the evacuations, there must be a chance under such conditions of infective material being spread about. This seems to be a mode of propagation that cannot be excluded; it is applicable to the other occupants of the wards, and especially applicable to the actual attendants on the fever cases.

With regard to the behaviour of the epidemic among the troops in barracks, from the preceding part of this section it appears that neither water, nor food, nor air contaminated with drain emanations, will explain the incidence of the disease; the one fact that stands out most clearly is that the fever has occurred in a number of small outbreaks, almost strictly localised in some place, or limited to some small body of men. Examples of this have been instanced in the case of G and H Companies, Essex Regiment, at Lower St. Elmo; A Company, Royal Dublin Fusiliers, at St. George's; the men of the Royal West Kent Regiment, who

occupied the Old Barracks, Floriana. In each of these instances, where several cases of fever occurred in the same room, or same set of rooms, there was an appreciably larger quantity of infective material in those rooms than in the barracks generally; the more there was of it present, the more likelihood would there be of the infection spreading.

There is one condition, common to Lower St. Elmo and Floriana Old Barracks, that would presumably be of importance in aiding this spread of infection. The rooms are casemates, most inadequately ventilated. If it be granted that the infective material is disengaged from the bodies of persons suffering from the disease, no better place could be found for its accumulation from day to day and night after night than a casemate such as those in question. It is extremely improbable that a thorough change of air ever takes place in these cavernous chambers. It is quite impossible that any thorough change should be effected frequently. The construction of the rooms and their size prevent it. I do not think it too much to say that the Long Ward in Valletta Hospital is in similar case as regards change of air. Though very large and lofty, the thorough change of the contained air is very difficult to effect; and as the upper windows have not (to the best of my belief) been fully utilised as outlets, I consider that there has been an accumulation of infective material in the air of this ward from day to day and night after night.

In regard to the barrack-rooms at St. George's that were so much affected (A Company, Royal Dublin Fusiliers), nothing can be said against their ventilation. But the bedcots are crowded together, so that only about 12 inches separate each pair of beds, and there has therefore been concentration of the persons, and, consequently of the infective material. It may be asked in this, as in the other cases where many barrack-rooms are similarly circumstanced, why some should be affected and not others. The reply would be that it is necessary that the poison should be introduced, and probably introduced in some notable quantity; having once been introduced, the conditions mentioned would naturally favour its spread.

There are two main difficulties to be met in adopting this theory, or explanation, of the prevalence. One arises from the fact that *M. melitensis*, though often sought for, has not been found either in the air of the Valletta Ward or in the dust collected from it, and from the Cottonera Wards. The other is that it has not been found possible, so far, to infect monkeys with urine-infected

dust. It must be admitted that these are substantial difficulties in the way of this explanation.

§ 7.

In regard to the question of transmission by fomites, the experiments of Horrocks, who found that *M. melitensis* could be recovered from khaki cotton, khaki serge, and blankets up to the 80th day; and of Shaw, who recovered it from blue serge up to the 78th day, show that this form of dissemination has practical importance. The necessity for disinfection of clothing, &c., is fairly obvious. The procedure that has been carried out has varied in the different corps stationed in Malta, as appears from the following statements obtained from the regimental authorities:—

Royal Garrison Artillery (Upper St. Elmo), 65th Company.—In the earlier part of the year the kit and bedding of men admitted to hospital were placed in the company store until instructions were received from the medical authorities that they should be sent to hospital for disinfection. Since the middle of August, in the case of all men admitted with “fever,” the kit and bedding have been put on one side in the “Old Magazine,” awaiting instructions as to their disposal.

96th Company.—It has always been the custom to put on one side the kit and bedding of all men admitted to hospital. When the case was declared to be “fever,” the whole kit and bedding has been sent to Cottonera Hospital for disinfection.

Tigne, 99th Company.—The kit and bedding of all men admitted to hospital have been placed in company store; on receipt of instructions from the medical officer in charge of the district, either “kit,” or “kit and bedding,” have been sent to the lazaretto for disinfection.

1st Company.—Same as 99th Company. In about half the cases “bedding” only has been specified, and the “kit” has not been disinfected.

102nd Company.—The kit and bedding of all men admitted to hospital are placed in company store. In infectious cases a paper of questions is sent by the medical officer to the commanding officer; one of these has reference to the kit and bedding; if they have not been disinfected they are to be sent to the lazaretto for disinfection. It may be ten days after a man has been admitted to hospital that instructions arrive as to disposal of kit.

Ricasoli, 5th Company.—When a man goes to hospital, his kit

and bedding are taken into the company store; if instructions come from the hospital authorities his "kit" is sent to Cottonera for disinfection, but *not* the "bedding."

63rd Company. Same as in 5th Company, except that the "bedding" is sent to be disinfected, but *not* the "kit."

100th Company. Same as in 5th Company; the bedding is *not* disinfected.

Hampshire Regiment (Verdala).—When a man reports sick, his kit and bedding are brought out of the barrack room and placed in the company store. If he is not admitted to hospital, he takes his kit and bedding back to the barrack room. If he is admitted, his kit and bedding are stored in the company store, the blankets being all stacked together in order, the sheets all together, and the mattresses all together. There is no certainty that a man receives the same blanket on discharge from hospital as he handed in when admitted. Sheets and pillow slips are washed. No difference is made between "fever" cases and others. Any dirty clothing in the kit bag remains *in situ*. In infectious cases, instructions come from the hospital authorities to the commanding officer that "kit and bedding" are to be sent to hospital for disinfection on some named date. Some days, a week or more, may elapse (after the man's admission) before these instructions are received.

Lancashire Fusiliers (Lower St. Elmo).—The kit and bedding of men admitted to hospital are stored in the company store (the prison cells being used for this purpose). The hospital authorities notify (after an interval of some days) when the kit and bedding are to be sent for disinfection. There are no means of keeping separate the kit and bedding of "suspected," *i.e.*, fever cases; but if any man is admitted with "fever," his kit and bedding are sent for disinfection on the first Tuesday or Friday that follows.

Essex Regiment (Imtarfa).—The bedding and blankets of men admitted to hospital are sent for disinfection when so ordered by the hospital authorities, but the kit remains in the man's kit bag, unless obviously dirty, in which case it is sent to the wash. Kits and bedding are stored in parts of barrack rooms appropriated for the purpose, there being no space for their disposal in the rooms labelled "company store," which are little better than cupboards.

Royal West Kent Regiment (Floriana).—Formerly, the bedding of men admitted to hospital used to be left in the barrack room. Early in the summer of 1905, the practice commenced of sending the bedding of *all* cases admitted to hospital to be disinfected, so as to be on the safe side. The kit has been kept in company store

in the two kit bags, and has not been sent for disinfection, nor have the dirty articles of clothing been washed, until the man's discharge from hospital.

Royal Dublin Fusiliers (St. George's).—Until the latter part of August only the bedding of cases of Mediterranean fever was sent to hospital for disinfection; cloth articles of clothing were exposed to the sun and brushed; khaki, underclothing, &c., was left in the kit bag *in situ* in company store. Since the beginning of September everything has been sent to be disinfected.

Rifle Brigade (St. Andrew's).—Same as Dublin Fusiliers.

From the above account it is obvious that the disinfection of the clothing and bedding of Mediterranean fever patients has been, during the greater part of 1905, far from complete. The want of uniformity in procedure is remarkable. Assuming that infective material may be present in soiled sheets, blankets, shirts, trousers, &c., there must have been opportunity for dissemination amongst the men of the same company, or unit, in many cases. In those instances where bedding (including blankets) has not been disinfected, it has been possible for the blankets or other articles that have been given into store by one man to have been taken into use by another man, as it is not the general practice to label the blankets, &c., individually; the company storeman would return to a man on discharge from hospital the same blankets that he had deposited in the store on admission, if he knew which they were, but this would not always be the case. In the instances when bedding has been sent to be disinfected on instructions being issued to this effect, there was generally an interval of a week or ten days before the instructions arrived, and during this time infection might be transferred to other blankets or bedding in contact with the infected articles. In those cases where the kit was not sent for disinfection, when the kit-bag was subsequently opened out, and any dirty shirts, &c., sent to the wash, there would be a chance of disseminating infective material. It is to be noted that, when a man goes to hospital, he generally puts on a clean shirt, &c., the dirty shirt, &c., going into his kit-bag. There is, therefore, some presumption that infective material might be present. When the washing day came round, sheets and pillow-slips would be sent to the wash; the dirty shirt, &c., might be sent to the wash, but it would more likely remain in the kit-bag until the owner came out of hospital.

As there were 487 cases of Mediterranean fever during the period under review, and therefore 487 bundles of bedding and kit to be handled, one would expect that if these articles were

infective, the "company storemen" who handle them would show some increased liability to contract the disease. But in only one case could I ascertain that a storeman had been attacked. This was Private Burch, Essex Regiment, who was admitted to hospital on June 3, 1905. He stated that it was his duty to handle the clothing and bedding of Mediterranean fever patients, and that sometimes this had been offensive, especially after having been fastened up in a bundle for some time.

It would seem to be probable that infection might be conveyed through infective fomites; and if this be the case, the measures of disinfection that were taken—up to September—could not be supposed to prevent this dissemination, looking at the whole question broadly. If a comparison, however, be made between the severity of incidence in the different corps and the method of treatment of presumably infected kit and bedding, it is seen that there is no general relation between the completeness of the disinfection and the severity of the attack ratio.

	Attack ratio per 1,000.		
Kit and bedding disinfected—			
Royal Garrison Artillery, 65th Company, Upper St. Elmo	..		83
" " " 96th " " "	..		69
" " " 102nd " Tigne "	..		32
Lancashire Fusiliers, Lower St. Elmo	63
Hampshires, Verdala	27
Kit disinfected, not bedding—			
Royal Garrison Artillery, 5th Company, Ricasoli	34
Bedding disinfected, not kit—			
Royal Garrison Artillery, 63rd Company, Ricasoli	18
" " " 100th " " "	42
Essex, Imtarfa	88
Royal West Kent, Floriana	45
Bedding disinfected, kit sunned and brushed—			
Dublin Fusiliers, St. George's	46
Rifle Brigade, St. Andrew's	54
Sometimes kit, sometimes bedding, sometimes both, disinfected—			
Royal Garrison Artillery, 1st Company, Tigne	68
" " " 99th " " "	54

Systematic and complete disinfection has been carried out in all cases, I believe, since the middle of September, 1905.

§ 8.

The discovery by Horrocks and Kennedy of *M. melitensis* in considerable numbers in the stomach contents of two species of mosquito (*Culex pipiens* and *Stegomyia fasciata*), indicates that transmission through the medium of biting flies is a possible mode of propagation. The arguments in favour of direct contagion or aerial transmission would apparently hold good equally in regard to mosquitoes, as carriers of infection, in places such as Malta,

where they abound. Granted the presence of infective material in a ward or barrack room, in the shape of hospital patients or ambulatory cases of the disease, transference to the healthy in this way becomes easily intelligible; the numerous localised outbreaks are explicable on this hypothesis as reasonably as by direct or semi-direct contagion. The only contribution that I am able to offer to this part of the subject is to mention that, of ninety-seven patients from whom a *definite* statement was obtainable as to their experience of mosquitoes, thirty-one asserted positively that they have never, or practically never, been bitten at all; eighteen stated that they had been bitten very slightly; while forty-eight admitted that they had been bitten a good deal. Without attaching much value to these statements (which, however, I believe to be accurate as far as they go), bearing in mind the rarity with which *M. melitensis* has been found to be present in the mosquito (four times in 896 individual mosquitoes), the chances seem to be very much against the entrance of the germ into the body having taken place in this way in the case of the forty-nine men who were either bitten but very slightly or not at all. But the number of men dealt with is insignificant.

SECTION IV.—CONCLUSION AND RECOMMENDATION.

The chief facts ascertained in this enquiry into the prevalence of Mediterranean fever amongst the troops in Malta have been summarised in Section III., § 1; the various modes of propagation of the disease that have been suggested by different observers have been considered in order, and, on the evidence of the facts ascertained, a negative conclusion as to their ability to explain the behaviour of this epidemic has been arrived at in regard to transmission (1) by water, (2) by milk or other articles of food, (3) by air contaminated with excremental (fæcal or urinary) effluvia; transmission (4) by direct or semi-direct contagion, or (5) through the agency of mosquitoes, appears from the evidence, to be more probable than in any other way; it is difficult to separate these two modes of dissemination the one from the other under the circumstances existing in Malta, and provisionally I think they may be considered together. Fully admitting that no proof has been afforded in support of this opinion, I still consider that there is a high degree of probability attaching to it, and one quite sufficient to warrant the adoption of certain measures of prevention or precaution.

Whatever view be taken of the mode of propagation, the fact is undoubted that certain barracks have suffered much more than

others; among these are Lower St. Elmo, Upper St. Elmo, and the old barracks at Floriana.

If considerations of economy and the maintenance of the health of the troops were the only things to be considered, probably the cheapest and most healthful course to pursue would be to evacuate these barracks altogether. If military considerations render this impracticable, I consider that an efficient alternative would be afforded if the following procedure were carried out:—

(1) Let it be recognised that these casemate barracks are entirely exceptional in their construction and need to be specially dealt with; the occupancy should be reduced from the present numbers (calculated on a cubic space of 600 cubic feet or less per head) to one which would allow 750 cubic feet *at the very least* per head, as is now admitted to be necessary in the case of all new barracks in the command. No height above 12 feet should be reckoned as available for ventilation in the calculation of this space.

(2) During the summer months tentage for 25 per cent. of the occupants of Lower St. Elmo should be drawn (as is the case in all the other barracks in Malta, except Imtarfa and Pembroke), so that the condition of the barrack rooms at night may be alleviated as much as possible in regard to heat, stuffiness and organic contamination of the air.

(3) As even under the best possible conditions, change of the air in these casemate barracks is very difficult, and accumulation of impurities on the walls and ceilings therefore much greater than in barracks of ordinary construction, all walls and ceilings of rooms and passages should be limewashed at frequent intervals, say, once a month; this would ensure the removal of dirt, the extermination (for the time) of mosquitoes, and for practical purposes would be a disinfectant measure. As the work could be done by the troops, the expense would be insignificant.

(4) There is sufficient evidence to warrant a presumption, at any rate, of localised infection, or semi-direct contagion. In the event of two cases of Mediterranean fever occurring in the same room within a fortnight, the barrack room should be evacuated and limewashed, the men being accommodated in tents for the time: after this has been done, the room might be re-occupied; but if another case occurs within a fortnight of re-occupation, it should again be evacuated, and the body of men isolated as far as possible.

(5) If in any company, or small detachment, several cases occur in quick succession (*e.g.*, two in one week, or three in a fortnight) this body of men should be regarded as infected. They should be placed under canvas, or transferred elsewhere; the measures suitable for

each individual outbreak of this kind can be decided on according to the special circumstances of each case. The remarkable freedom from fever experienced by the Gozo detachments of the Essex Regiment (which regiment suffered so severely at Lower St. Elmo) indicates that, if any small infected body of troops were removed from their surroundings to a detached spot (*e.g.* Gozo, or Mellieha, &c., &c.), and scrupulous attention paid to their sanitation in every detail, the infection may be expected to die out. Once it is evident that a body of men is infected, the sooner the move is made the better; probably a very short distance would suffice; but there must be no overcrowding, and every detail of sanitation must be carefully attended to. The rooms evacuated should be fully disinfected with formalin or other disinfectant.

(6) The above recommendations refer especially to the three old barracks that have suffered severely from Mediterranean fever; there are other old barracks of similar defective construction to which the same recommendations are applicable, though Mediterranean fever has not been especially prevalent in them during the past year. Such are St. James Cavalier, Salvatore Counter Guard, St. Francis' Barracks, Marsamuscetto, Old Laboratory, all the barracks in the Cottonera Lines, and Fort Chambray, Gozo. In all of these the recommendations as to 750 cubic feet of space per head, 12 feet of height only being reckoned for the calculation of space, frequent limewashing, and evacuation and disinfection on the occurrence of Mediterranean fever, equally apply. Although they have not suffered in 1905, their defects are such that a prevalence of the disease is to be feared, if the infection be introduced in sufficient amount. Tentage is already authorised to be drawn for these barracks in the hot weather.

(7) In the modern barracks in Malta, which are so satisfactory in their construction and general sanitary conditions, the above recommendations do not appear to be necessary; but the principle of a stitch in time equally holds good; any succession of cases in a barrack room would indicate the advisableness of evacuation, disinfection, and isolation.

(8) The defects in the supply of water for sanitary purposes throughout the Cottonera district (including Verdala), at St. James Cavalier and at St. George's require immediate attention. The provision of an ample supply of sea water, or No. 2 water, in order to flush the latrines and drains properly, is such an obvious necessity, that it is strange that a recommendation to this effect should require to be made. Increased pumping power appears to be what is wanted, but this is a matter for the Royal Engineer depart-

ment to determine. The necessity is urgent. Latrines should be flushed at least three times a day, and four times a day if water is available.

(9) The management of urinals has not been properly carried out: systematic application of "heavy oil," or some efficient substitute (such as colza oil and tar, as used at Imtarfa); the omission of water flushing for the stalls (which, strangely enough, has very generally been used along with the oil treatment); but the careful washing of the floors of urinals, and flushing of the urinal drains with water; these are the measures indicated.

(10) Where the dry-earth system of excreta removal is still in use, a removal of three times instead of once in the twenty-four hours is recommended; this will necessitate the provision of suitable receptacles for the pail contents. The present system is too barbarous and offensive to be tolerated. There is no reason why what is strictly forbidden in India should be universally permitted in Malta: I refer to the retention in the latrines of pails, full of filth, for the greater part of the twenty-four hours. The nearest approach possible to the *immediate* removal system (according to the Indian fashion) should be made. It is to be hoped that the dry-earth system will, before long, be completely abolished in Malta, except for temporary camps.

(11) If the above recommendations (8) to (10) are carried out, it is to be expected that the contamination of the air of barracks generally by excremental emanations, also the risks due to disease conveyance by flies, will cease; until this is the case no barrack can be considered to be in a good sanitary condition, whether in reference to Mediterranean fever or any other infectious disease. There is one special preventive measure directed against Mediterranean fever infection that has been carried out during the past year, viz., the boiling or "pasteurising" of milk for the troops. This requires to be continued in the strictest possible manner. As regards the married families, for whom this is more important than for the troops, it might be feasible to provide Aymard sterilisers to treat the milk supply of the large married quarters centrally, and therefore more effectually. If this is impracticable, special instruction and warning should be continually given, not only to new arrivals, but to all the married people, as to the necessity for sterilising goats' milk, or else substituting condensed milk for it.

(12) As success in dealing with this disease, as in other infectious fevers, will probably largely depend on stopping the beginnings of an outbreak, *i.e.*, carrying out the principle of *Obsta*

principiis; perhaps the most important thing of all is to find out as early as possible when and where anything like an epidemic prevalence is commencing. The existing arrangements for arriving at a diagnosis are satisfactory; if, however, this could be expedited, it would be very desirable that it should be done. But what is required, in my opinion, is some method of tracking out the cases as soon as they occur; not waiting for a final diagnosis, which cannot be arrived at for perhaps ten to fourteen days, but examining the patient, his surroundings, habits, movements, &c., &c., whenever there is even a *probability* of the case being one of Mediterranean fever. Information can be easily obtained at the time, which afterwards can only be got at with difficulty and labour, or not at all. The existing establishment of medical officers is not, in my opinion, adequate for this work, they being all fully employed as it is, especially during the summer months, when the sickness is greatest. I consider, and recommend, that two extra medical officers be employed to give their whole time to this epidemiological investigation work, over and above the work that has been hitherto and is now being done in the laboratories and in the various hospitals. The tracking out of the early cases by a skilled observer ought to lead to important results in the way of ascertaining modes of infection, and, consequently, the carrying out of effectual measures of prevention. I do not think that one medical officer would be sufficient, the ground to cover is too extensive, and the investigations must be undertaken without delay in each case; in the summer months, at least two officers would be busily occupied every day. They should be employed for this purpose only.

(13) Immediate and effectual disinfection of clothing and bedding of men admitted to hospital with Mediterranean fever, and of patients in hospital suffering from this disease, should be carried out as a matter of course. To be effectual, the disinfection must be complete, not as was formerly the case.

(14) Isolation of Mediterranean fever patients when in hospital is indicated. The difficulty is to carry it out at Valletta Hospital.

(15) The management of the Long Ward at Valletta Hospital, so as to ensure proper change of air, is a very difficult problem to solve. I am convinced that much more ventilation, a much more frequent and thorough change of air than has hitherto been the case, is required. More advantage might be taken than was the case last summer of the existing windows in the upper storey. A new hospital is urgently required, as has been insisted on for about thirty years past.

GLOSSINA PALPALIS IN ITS RELATION TO *TRYPANOSOMA GAMBIENSE* AND OTHER TRYPANOSOMES
(PRELIMINARY REPORT).¹

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INTRODUCTORY.

IN this paper we propose to give a brief statement of the results obtained by us with reference to the relation of the tsetse-fly (*Glossina palpalis*) to the trypanosome of sleeping sickness (*Trypanosoma gambiense*), and to other species of trypanosomes which this fly carries.

Our investigations have consisted of observations and experiments upon (A) Flies fed in the laboratory on animals which had been infected by the inoculation of cerebro-spinal fluid from sleeping sickness patients, and which showed trypanosomes in their blood as the result of such inoculation; (B) Flies caught in various localities which were found on dissection to contain trypanosomes in their digestive tracts.

Of the trypanosomes under the latter heading (B) we have found two distinct types. One of these types has been named by Professor F. G. Novy² *Trypanosoma grayi*, and one of us (Professor E. A. Minchin) proposes to call the other type *Trypanosoma tullochii*.

Type I. *T. tullochii*, n. sp. Minchin.—This type is distinguished by its more rounded nucleus placed near the middle of its body, by a small, usually circular, blepharoplast placed well behind³ the nucleus, *i.e.*, at the end furthest from the flagellum.

Type II. *T. grayi*, Novy.—This form is characterised by its large nucleus, which may be oval, spherical, or compressed, and which is in all cases situated not far from the posterior end of the

¹ Reprinted from *The Proceedings* of the Royal Society by permission.

² *Journal of Infectious Diseases*, vol. 3, No. 3 (May, 1906), pp. 394 to 411, Plates 15 to 17. Professor Novy gives some excellent microphotographs of these trypanosomes, taken from preparations sent him by Lieutenant Gray.

³ In this memoir we use the terms anterior and posterior purely with reference to the direction of locomotion of the trypanosomes described by us, and without prejudice to the disputed morphological questions involved.

body. In many cases the nucleus shows distinctly eight chromosomes. The blepharoplast is large, transversely elongated, and situated close to the nucleus, either at its side or more usually anterior to it. Sometimes, however, it may be posterior to the nucleus, a point which we discuss further below. The flagellum is often distinctly thickened at the tip. This type varies very greatly both in form and size. We distinguish (1) male forms, very slender, with long free flagellum, with nucleus very compressed, and with the blepharoplast situated in front of it. Some of the forms reach an extraordinary length. (2) Female forms which are bulky, often thickened at the posterior end, and with an oval or rounded nucleus. The blepharoplast is variable in position, and the free flagellum is very short. (3) Young forms and indifferent forms, varying greatly in character; among the latter we may particularly note forms which are nearly spherical. The very protean character of these forms makes it very uncertain as to whether they are really all of the same species. Since, however, we have noticed a marked difference between trypanosomes from flies which had fed after being caught and those in flies which had not fed, we think that these variations of type are to be explained as the result of the conditions of nutrition of the host. The forms from flies which had not been fed were both scarcer and larger than those from flies which had recently sucked blood. In flies dissected soon after feeding it was found that small forms largely predominated, and dividing forms were numerous; on the other hand, in those cases in which flies were found to contain forms of a more indifferent character it was noticed that stages of division were extremely rare, and that aggregations of similar forms into large masses were frequent.

The mode of division in *T. grayi* is noteworthy and characteristic. The two sister individuals which result from it are markedly unequal in size and differ also in the relations of their nucleus and blepharoplast. The smaller of the two has the blepharoplast placed in what may be considered the normal position, that is to say, well in front of the nucleus. On the other hand, the larger individual has the blepharoplast placed behind the nucleus. We consider, therefore, that the forms not infrequently found, in which the blepharoplast is situated behind the nucleus, represent, in many cases at least, the larger of two sister individuals resulting from recent division. Multiplication by division has only been observed by us in individuals of indifferent or female type, never in fully differentiated male forms. Finally, we may draw attention to

the numerous chromidia always present in young, indifferent, or female forms. In their staining reactions the chromidia seem to resemble the blepharoplast more than the nucleus.

(A) *Observations and Experiments with Flies Artificially Infected with T. gambiense.*—We undertook very numerous experiments to determine the exact mode of infection by the fly, particularly with the object of determining whether the fly became infectious at any definite period after having been fed on an infected animal. For instance, a batch of freshly caught flies was fed first on an infected animal, and then fed on successive days on a series of healthy animals, using a fresh animal for each feed, the experiments covering a period of twenty-two days from the time of the original infection of the flies. All such experiments, however, gave entirely negative results. On the other hand, we obtained positive proof that *G. palpalis* can convey trypanosomes by means of its proboscis from an infected to a healthy animal, if it goes straight from the one to the other. Our method of experimenting was as follows: A single fly was placed in a test-tube and the mouth of the tube covered with gauze. The mouth of the tube was then pressed on to the infected animal and the fly carefully watched. When the fly had about half fed it was removed from the infected animal and placed on a healthy one, on which it was allowed to finish its meal. Infection by trypanosomes was effected by this means in four out of five experiments when *G. palpalis* was used as the transmitting agent, and once out of four experiments when a *Stomoxys* was used in a similar manner. In order to determine further whether in these cases the infection was brought about by contamination with the fly's proboscis only or by the possible regurgitation of already ingested trypanosomes from the digestive tract, a further series of experiments was carried out, in which the fly, after having partially fed on an infected animal, was then allowed to feed on two healthy animals in succession. Five such experiments were carried out, in each of which it was observed that the fly (*Glossina*) had sucked blood from both the infected and the two healthy animals. In every case the *first* of the two healthy animals, and only the first, was infected, even when the fly had only been allowed to dip its proboscis for a moment into the first healthy animal and was then immediately transferred to the second healthy animal. This shows, in our opinion, that the infection is conveyed by contamination of the proboscis, and that if the fly be allowed to clean its proboscis by piercing the skin of one animal, it is no longer infectious to a second. In these experiments upon direct transmission the "Jinja"

cattle-trypanosome was used by us, because it is abundant in the blood of infected animals (rats) with which we were working, and also on account of the fact that the infection or non-infection of a rat with this trypanosome is a matter of certainty within a very few days, whereas had we used *T. gambiense* the results of our experiments would have remained uncertain for a very long while.

It has also been proved by the experiments of Bruce and by ourselves that freshly caught specimens of *G. palpalis*, at Entebbe, are capable of infecting animals with the trypanosome of sleeping sickness, but in this case all experiments seem to show that the number of fly-bites required to produce infection is a very variable one indeed, since over and over again more than 1,000 flies have fed on a susceptible animal without infecting it. The smallest batch with which we ourselves have been successful in producing infection consisted of one hundred and thirty-four flies.

Observations on the fate of trypanosomes introduced into the digestive tract of the tsetse-fly by feeding it in the laboratory upon animals infected with *T. gambiense* gave the following results: The trypanosomes, never very numerous in the ingested blood, show at the end of twenty-four hours a slight increase in number, and many of the parasites are observed in stages of division. At the same time they have become differentiated into two very distinct forms. The first is a very slender type with cytoplasm free from granules, with the nucleus sometimes rounded but more usually compressed, and with a considerable length of free flagellum. Many of these slender forms are observed at this stage to be in the act of extruding granules of chromatin from the nucleus. The second form of parasite is relatively very large and bulky, with granular and deeply-staining cytoplasm, with very large spherical nucleus, with short free flagellum, and with the blepharoplast often some distance from the posterior end. These two forms may be regarded, on the analogy of developmental facts recorded of other trypanosomes, as male and female respectively. In both forms stages of division were observed, but in no case have we succeeded as yet in observing with certainty any process of conjugation. The two forms are easily distinguished in the living condition, the slender males being also characterised by much greater activity than the bulky females.

Male and female forms could also be recognised in the blood of the experimental animals (monkeys), especially in films fixed with osmic vapour. In films dried in the ordinary way the characteristic differences were much less distinct. In either case the differentia-

tion of sexual characters is far less marked than it becomes in the intestine of the fly. Trypanosomes of male character are common in blood-films, but those of female character are very scarce, and only two were found, both of which were remarkable for having the nucleus composed of four distinct masses of chromatin. On the other hand, an abundant form in the blood films is an indifferent type, characterised usually by a very short free flagellum, and it is this form which develops into the female form in the fly. In this connection attention should be drawn to the forms, distinctly of the female type, obtained by two of us (Gray and Tulloch) in a culture (see Appendix II.).

It may be pointed out that the sexual forms of *T. gambiense* from the tsetse-fly are very similar to the forms of *T. brucei* described by Koch¹ from other species of *Glossina*, so far as can be judged from Koch's figures. It is our opinion, however, that many of the forms described by Koch as developmental stages of *T. brucei* are really stages of one or more distinct species of trypanosomes carried by the flies, comparable to, and perhaps identical with, *T. grayi* and *T. tullochii* in *G. palpalis*.

At forty-eight hours after feeding the trypanosomes are still numerous in the intestine of the fly, and a type of more indifferent character begins to make its appearance. At seventy-two hours the trypanosomes are usually beginning to become more scanty and difficult to find in the digestive tract of the fly, although in some cases they are still numerous and chiefly of the indifferent type. At ninety-six hours, in almost every case, not a single trypanosome could be found even after the most careful searching. In one case a single trypanosome was found, and in another case two, on the fourth day, but in all other cases the trypanosomes seemed to have vanished completely at this period, and could never be found at any subsequent time. It would appear as if they had died out with the absorption of the blood with which they were ingested, and were unable to pass forward in the digestive tract into the blood taken up by the fly at any subsequent feeding. In this they contrast sharply with the trypanosomes described above, occurring in the fly under natural conditions.

The disappearance of *T. gambiense* from the digestive tract of the tsetse-fly could be interpreted in one of three ways: (1) the trypanosomes may actually die out and be digested; (2) the trypanosomes may pass from the digestive tract into other organs of the

¹ *Deutsch. Med. Wochenschr.*, 1905, No. 47.

fly; (3) the trypanosomes may become, by rapid division, so minute as to escape detection, like the forms of *Spirochaeta ziemannii* described by Schaudinn, or like the invisible micro-organism of yellow fever. In order to test the second of these two possibilities, the internal organs of a number of artificially infected flies were carefully examined, but always with negative results, while the experimental results of Bruce and ourselves seem to disprove infectivity of the fly at any period after forty-eight hours, and, therefore, render improbable the third possibility suggested above. So far, then, as it is possible to draw conclusions from our observations, it would appear that *T. gambiense* does actually die out in the tsetse-fly after the third day. In all cases *T. gambiense* was found only in the mid-gut of the fly, and appeared never to pass either backwards into the proctodæum or forwards into the proventriculus, another point in which they contrast with the "fresh fly trypanosomes."

(B) *Observations and Experiments upon Freshly-caught Tsetse-flies Found to Contain Trypanosomes.*—When freshly-caught tsetse-flies were examined by us in the laboratory, either after having been fed upon a healthy animal or not, a certain percentage of them were found to contain trypanosomes of one or, rarely, of both types referred to above as *T. grayi* and *T. tullochii*. In such cases the trypanosomes were usually present in enormous numbers, especially if the fly had been previously fed. These trypanosomes, when compared with *T. gambiense*, artificially introduced into a fly's intestine, are distinguishable by their appearance and movements. They are far more active than the sluggish *T. gambiense*, especially the male forms, which often shoot across the field of the microscope with the greatest rapidity. When moving in this way the body of the parasite remains nearly stiff, while the forwardly directed flagellum vibrates with rapid serpentine movements. In a few cases they were found in masses in the proctodæum, but in most cases they occurred in the intestine, swarming and multiplying in the freshly ingested blood. Occasionally they were found passing along the thoracic intestine into the proventriculus. The parasites found in the proventriculus did not differ appreciably either in size or appearance from those found in the digestive tract. By the method suggested by Koch, of compressing the bulb of the proboscis, we succeeded in forcing trypanosomes out from the proboscis, but only in those flies in which the parasites were found in the proventriculus. Of the two types described above, *T. grayi* was the most commonly found, being present in 1.47 per cent. of a total of 3,000

574 *Glossina Palpalis in relation to Trypanosoma Gambiense*

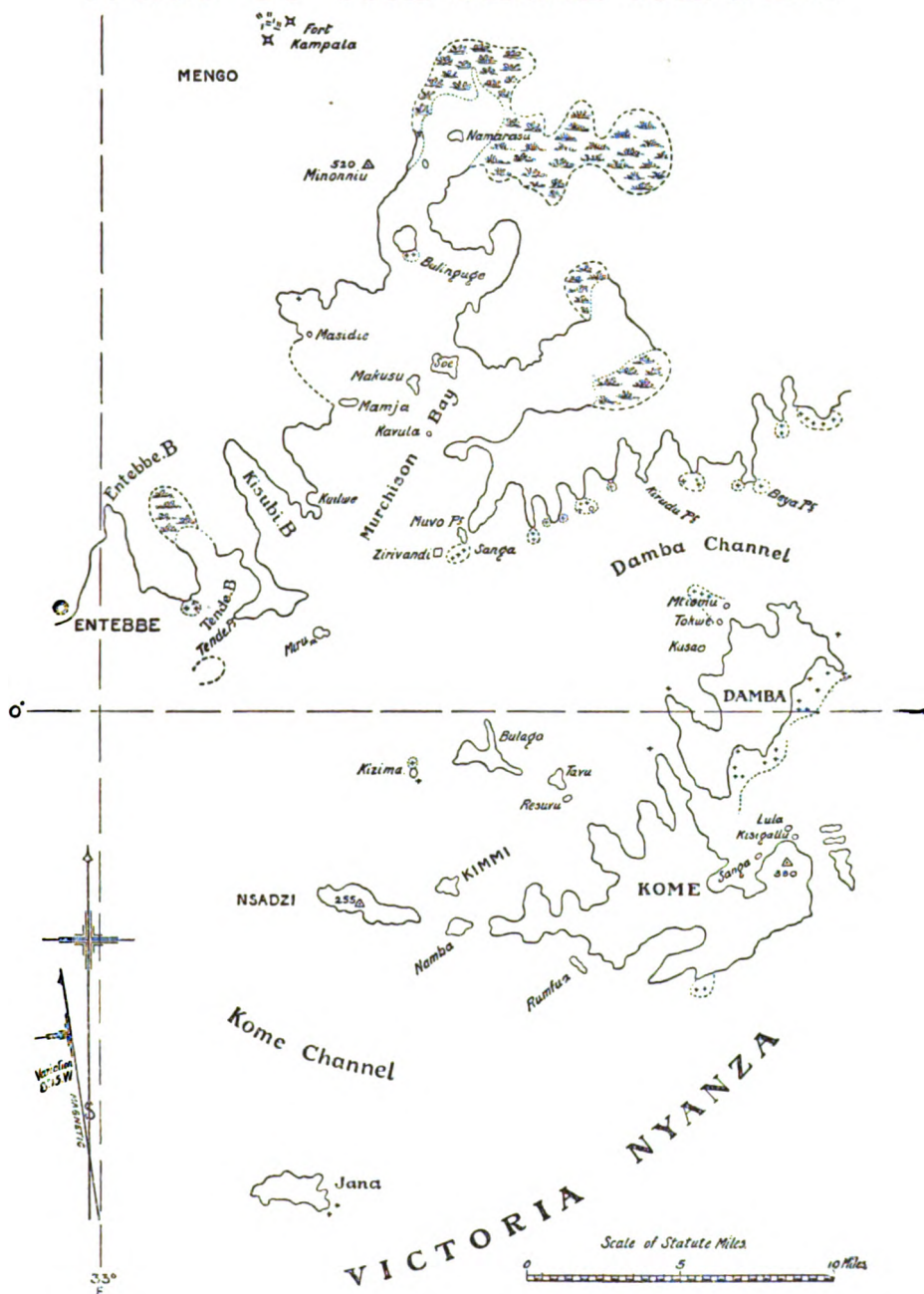
flies examined, while *T. tullochii* was found in 0·17 per cent. of flies, and both trypanosomes together in the same fly only three times. When trypanosomes were found in the fly's proventriculus it was more usually *T. tullochii* which was present, while when trypanosomes were found only in the fly's intestine it was more usually *T. grayi* that occurred, but no conclusions can be drawn from this until more flies have been examined.

The object of our experiments on these "fresh fly trypanosomes" was to determine whether one or both of the two types found were or were not developmental stages of *T. gambiense*. As it is now beyond all doubt that *G. palpalis* is the agent which conveys the trypanosome of sleeping sickness from an infected to a healthy individual, it would seem most probable at first sight that any trypanosomes found in the bodies of these tsetse-flies caught in a sleeping sickness area would be developmental stages of *T. gambiense*. We felt no doubt at the outset of our investigations that these fresh fly trypanosomes were to be identified with *T. gambiense*. Koch¹ evidently worked on the same assumption, since in his comparison of the supposed developmental stages of *T. brucei* and *T. gambiense* there can be no doubt that he has taken the form which has been called *T. grayi* for a developmental phase of *T. gambiense*. As we proceeded, however, with our investigations we were gradually led to doubt any connection between these "fresh fly trypanosomes" and sleeping sickness. In order to determine this point we carried out a number of experiments on flies caught on the island of Kimmi. The island was chosen because it swarmed with these tsetse-flies, of which a high percentage contained trypanosomes, and because it was, and has been for a very long while, quite uninhabited.

Kimmi is a small island of the Sesse group, about two miles long by a mile wide (*see map*). There is a narrow strip of sandy shore all round it, the remainder of the island being covered with thick undergrowth and forest. On the foreshore are many ambatch trees, where cormorants, other diving birds, and weaver birds are very plentiful. This island is a regular feeding ground for hippopotami, and is crossed in all directions by their tracks. Crocodiles are also very numerous. Kimmi is situated about fifteen miles from Entebbe, and is two miles from Nsadzi Island in the one direction and from Kome Island in the other. For more than a year this island has been quite uninhabited, and natives now

¹ *S. B. k. pr. Akad. Wiss. Berlin*, 1905, pp. 958 to 962.

PART OF THE SESSE ISLANDS



never visit it. The whole island swarms with tsetse-fly (*G. palpalis*). In spite of the total absence of human beings on Kimmi Island, we found that more than 7 per cent. of the tsetse-flies caught there contained trypanosomes of one or other of the two types mentioned, while only 1·7 per cent. of the flies caught on the main land near Entebbe, a place with a numerous population, among whom sleeping sickness is common, contained similar parasites.

Our method of experimenting with these flies was as follows: Our camp with our apparatus and experimental animals was placed on the neighbouring healthy island of Nsadzi, in a region free from fly and where there is no sleeping sickness. A steam-launch was placed at our disposal by the authorities, and by means of it batches of flies were brought back from Kimmi, so that we were not obliged to take possibly infected native canoe-men, a class among whom sleeping sickness is very common, to this island. These Kimmi flies were divided into batches, and each batch assigned to a particular animal (monkey, rat, guinea-pig, or hen) on which the batch was fed at once, and again repeatedly on successive days. After twelve days or a fortnight of such daily feeding, the flies of each batch were dissected and examined for trypanosomes which they might contain. In practically every case one or more flies of each batch were found to contain trypanosomes, so that every experimental animal was definitely known to have been fed upon repeatedly by at least one fly containing trypanosomes. Had these trypanosomes therefore been identical with *T. gambiense*, it might have been expected that at least some of these susceptible animals (such as monkeys, guinea-pigs, and rats) would have become infected, *but this did not occur in a single instance*. We thought that *T. grayi* might possibly be a bird-trypanosome, but the negative results of feeding flies containing it on fowls did not bear out this supposition.

In addition to these feeding experiments, we inoculated other experimental animals of the same kinds with the contents of the various parts of the digestive tract of flies containing these trypanosomes, some from the proventriculus, some from the intestine and some from the proctodæum, *but again in every case the results were negative*.

We are, therefore, now convinced from the results of these numerous experiments, of which a list is given on p. 579, *that the trypanosomes found in the freshly caught tsetse-flies, and referred to by us as T. grayi and T. tullochii, have nothing to do with sleeping sickness and are not developmental stages of T. gambiense*.

It is a matter of regret to us that we have not been able to establish on what vertebrate host, if any, these trypanosomes are parasitic. It seemed at least probable that *T. grayi*, some forms of which greatly resemble *T. johnstonii*, Dutton and Todd,¹ from *Estrela estrela*, was taken up by the fly from some of the numerous water birds that haunt the lake-shore. On the other hand, *T. tullochii*, which is very similar in its morphological characters to *T. gambiense*, might similarly be derived from a mammalian host. We may draw attention in this connection to the remarkable manner in which the tsetse-fly haunts the lake-shore. There is nothing in the breeding habits of the fly which should oblige it to frequent the vicinity of water, as in the case of the mosquito. Our experience of flies kept in the laboratory convinced us that a certain amount of moisture is necessary for them, since they died much faster in their cages if not kept over water. It may be supposed, however, that one attraction that the lake-shore exerts upon this voracious blood-sucker is that of food-supply. Along the shores of the lake and on all the small islands are vast numbers of cormorants and other fish-eating birds, perched with their wings extended, drying themselves in the sun on the trees, and especially on the ambatch trees, where the flies are found in swarms. These birds might furnish one constant and important source of food. We found in the laboratory that tsetse-flies fed very rapidly on captive fowls, creeping under their wings to bite the poorly protected parts of the skin. On the other hand, when a heap of recently shot water-birds, some of which were hardly dead, were lying on the lake-shore at Kimmi Island, the swarms of tsetse-flies did not attempt to settle on them, although freely biting us and our servants. A second possible source of food supply is furnished by the aquatic animals of the lake-shore, such as the hippopotamus, the otter, the crocodile and the python. We have definite evidence that the fly feeds on the hippopotamus and on the crocodile. Flies were caught in the act of biting a hippopotamus just recently shot, settling chiefly on the ears and nose. We, therefore, made blood-films and had blood-films sent us of as many aquatic birds and animals as possible, including five or six hippopotami. Only in a single case did we find a trypanosome, namely, in a not very well preserved film of crocodile's blood; beyond its large size and general resemblance to other reptilian trypanosomes, it was not possible to make out any details of structure in this parasite. We

¹ Liverpool School of Tropical Medicine, *Mem.* XI., Pl. 2, fig. 1.

578 *Glossina Palpalis in relation to Trypanosoma Gambiense*

may mention, however, that the blood of many of the birds contained Halteridia, and that a Hæmogregarine was quite common in the blood of the crocodiles (fig. 1). We also observed that flies in captivity sucked the blood of lizards, chameleons and snakes very freely.

There are, therefore, two possible sources for the trypanosomes in the freshly caught tsetse-flies. Either they are taken up from some of the numerous animals upon which the fly feeds, or they may be parasites of the fly itself, like *Herpetomonas muscæ-domesticæ* in the house-fly. In this respect it is interesting to note that a small percentage of another common blood-sucking fly in Uganda (*Stomoxys* sp.) contain a species of *Herpetomonas* very similar to that of the common house-fly in Europe. With regard to *G. palpalis* we were never able to obtain any definite proof that it fed on any-

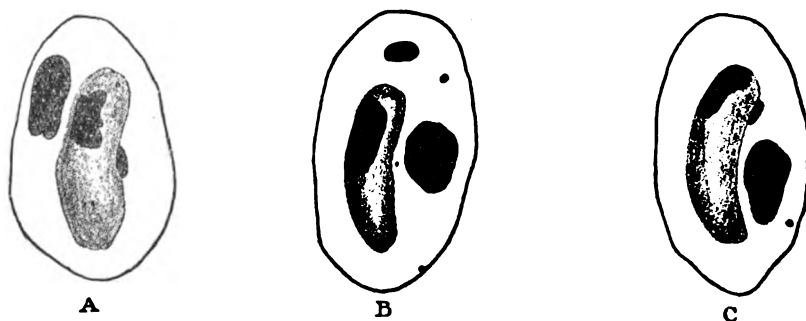


FIG 1.—Hæmogregarine in the red blood corpuscles of the crocodile. $\times 2,000$.

thing but blood. It is therefore difficult to understand how a parasite of the tsetse-fly itself could be conveyed from one fly to another except by the hereditary method. We have a single instance to record which certainly suggests hereditary transmission of these trypanosomes. A tsetse-fly was bred in the laboratory in August and was fed for two months on fowls, which were, unfortunately, also used for feeding our stock of tsetse-flies in our breeding cages. On October 9th the fly was fed on a monkey showing very scanty trypanosomes (*T. gambiense*) in its blood. The next day, twenty-one hours later, this fly was dissected and found to contain a few scanty *T. gambiense* and vast swarms of *T. grayi*. It is obvious, therefore, that this fly was either infected with *T. grayi* when it emerged from its pupa, or that it became infected from one of the fowls, which had possibly been infected in its turn by the

fresh flies which fed on it. It may be mentioned in this connection that experiments directed towards obtaining flies infected with *T. gambiense* by the hereditary method, that is to say, by breeding from flies fed continually on infected animals, gave no result.

In conclusion, one remarkable experiment of ours may be mentioned. At our camp on Nsadzi, referred to above, we fed a large number of freshly-caught Kimmi flies on a goat which we obtained from natives on the island. We then dissected these flies, and, to our astonishment, could not find trypanosomes in a single one of some five hundred flies which had so fed, whereas in other Kimmi flies, caught at the same time, which had fed on our other experimental animals (monkeys, &c.), trypanosomes were present in the usual proportion. We then prepared some goat's serum and added a drop of it to the contents of a fly's intestine teased out on a slide, which contained *T. grayi* in large numbers. Another drop of this same goat's serum was added to a preparation of *T. gambiense* obtained from an infected rat, and the two preparations watched. It was found that in the preparation of *T. grayi* the trypanosomes rapidly became immobile and died off, while the *T. gambiense* remained active. We then tried the same two experiments over again, using human serum instead of the goat's serum, and then found that the trypanosomes were not affected in either case. This result seems to us to furnish an additional means of distinguishing between *T. gambiense* and *T. grayi*.

APPENDIX I.

TABLE I.

List of animals on which tsetse-flies, known to contain trypanosomes of the two types mentioned, have fed. All these animals remained uninfected by this feeding.

Animal	Number of flies which had fed found to contain trypanosomes	Class of trypanosome present in fly	Presence or absence of trypanosomes from fly's proventriculus
Monkey No. 370 ..	2	<i>T. grayi</i> .	
" No. 391 ..	3	"	
" No. 369 ..	2	"	
" No. 397 ..	1	"	Present.
" No. 335 ..	3	<i>T. grayi</i> in two flies, <i>T. tullochii</i> in one fly	Present in one of the former.
" No. 474 ..	2	<i>T. grayi</i> in one and <i>T. tullochii</i> in the other	Present in both.
" No. 499 ..	4	<i>T. grayi</i>	Absent in all.
" No. 525 ..	5	"	" "
" No. 553 ..	1	"	Absent.
" No. 554 ..	4	"	Present in one fly.

APPENDIX I.—TABLE I.—(continued.)

Animal	Number of flies which had fed found to contain trypanosomes	Class of trypanosome present in fly	Presence or absence of trypanosomes from fly's proventriculus
Monkey No. 473 ..	2	<i>T. grayi</i> in one and <i>T. tullochii</i> in the other.	Present in both.
„ No. 498 ..	4	<i>T. grayi</i>	Absent in all.
„ No. 555 ..	1	„	Absent.
„ No. 556 ..	3	„	Present in two.
„ No. 557 ..	1	<i>T. grayi</i> and <i>T. tullochii</i> together	Present.
Guinea-pig, F.F. ..	8	<i>T. grayi</i> in 7, <i>T. tullochii</i> in 1	Present in two.
„ No. 528	5	<i>T. grayi</i>	Absent.
Rat (white), No. 533	1	<i>T. tullochii</i>	Present.
Hen, No. 505 ..	4	<i>T. grayi</i>	Present in two.
„ No. 506 ..	6	<i>T. grayi</i> in 5, <i>T. tullochii</i> in 1.	Present in three.

APPENDIX II.—*An Experiment on the Cultivation of T. gambiense.*
By Lieutenant A. C. H. GRAY, R.A.M.C., and the late Lieutenant F. M. G. TULLOCH, R.A.M.C. (Sleeping Sickness Commission).

Our numerous failures in this direction have been attended by one partial success.

The following method was employed. A tube of agar, prepared according to the formula of McNeal and Novy, was melted and cooled to 60° C. Three times its volume of blood, taken directly from the heart of a dog without defibrination, was added to the agar. The water of condensation was inoculated with a drop of blood from a white rat (No. 513) very rich in trypanosomes. On examining the tube six days later a few living trypanosomes were found, which appeared similar to the forms inoculated. On the eighth and tenth days no trypanosomes were seen in a loopful of fluid withdrawn from the tube. On the fifteenth day several active trypanosomes were seen in a sample. These trypanosomes were found singly and in groups of three or four. Dividing forms were also seen. These forms were distinctly larger than the trypanosomes originally inoculated, and on measurement were found in some cases to be as long as 54 μ . Besides being longer and broader than the trypanosomes in the blood of the rat, the position of the micronucleus was different. In the trypanosomes from the test-tube the micronucleus was situated at a considerable distance from the hinder end of the parasite, and consequently nearer to the macronucleus. These trypanosomes closely resembled certain forms which we have found in the stomach and intestinal tract of tsetse-flies twenty-four hours after being allowed to feed on infected monkeys. On the seventeenth day trypanosomes were still present in about the same

numbers, but a few cocci were also found in the tube. Up to the twentieth day trypanosomes were still found, but were sluggish in their movements and became fewer in number as the cocci increased. After this date the growth of cocci became profuse and the trypanosomes died off. Up to the present (seven days) no trypanosomes have been found in sub-cultures made from this tube, although the latter are free from bacteria.

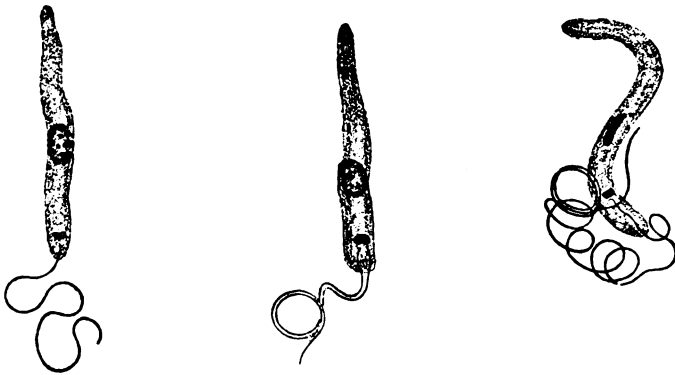
As multiplication had commenced in the original tube, it is reasonable to expect that a successful culture would soon have resulted if it had not become contaminated by cocci.

The resemblance of the newly formed trypanosomes to forms seen in tsetse-flies after feeding on infected animals, is of interest.

APPENDIX III.—*Some Notes on a Herpetomonas found in the Alimentary Tract of Stomoxys (calcitrans ?) in Uganda.*

By Lieutenant A. C. H. GRAY, M.B., R.A.M.C.

In the course of examining the contents of the alimentary tract of some specimens of *Stomoxys (calcitrans ?)*, which had previously been allowed to feed themselves on a monkey infected with the trypanosome of sleeping sickness, I found a species of *Herpetomonas* in the alimentary tract of three flies out of a total number of two hundred and eighty examined.



× 2,000

FIGS. 2 to 4.—*Herpetomonas* from the gut of *Stomoxys (calcitrans ?)*; fig. 2, common form with single flagellum, and with nucleus broken up into separate masses; fig. 3, commonest form, with double flagellum; fig. 4, form with compressed nucleus and very long flagellum.

In its movements, size, and general appearance, the flagellate seemed to closely resemble *H. muscæ-domesticæ* of the common house-fly.

In two flies this parasite was present in very large numbers.



FIGS. 5 to 7.—*Herpetomonas* from gut of *Stomoxys*; fig. 5, small form with dividing nucleus; fig. 6, small form showing the posterior position of the blepharoplast, and long intracellular course of the flagellum; fig. 7, small form, ordinary type,



FIGS. 8 to 10.—*Herpetomonas* from gut of *Stomoxys*, non-flagellated forms; fig. 8, mass of blue-staining protoplasm containing one large chromatin body; figs. 9 and 10, masses of protoplasm containing paired chromatin bodies.

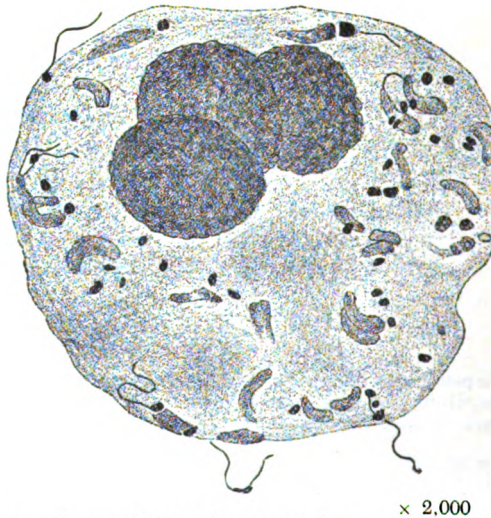


FIG. 11.—Large cell (probably a leucocyte) from contents of gut of *Stomoxys* (*calci-trans*?), containing in its interior large numbers of disintegrated *Herpetomonas* forms.

Those two flies were full of blood from the monkey they had fed on twenty-four hours previously, and in this blood practically unaltered *T. gambiense* were present in scanty numbers. In the third fly this *Herpetomonas* was present in very scanty numbers and no trace of recently ingested blood could be found in it.

Films, fixed in osmic acid and stained with Borrel blue and eosin, showed that the commonest type of this parasite measures from 35 to 50 μ (figs. 2 to 4). The body of the parasite is cylindrical, with a rounded anterior and more pointed posterior extremity. The protoplasm of the body stains rather deeply. A large rounded nucleus is placed at the centre of the body of the parasite. The chromatic substance of the nucleus is sometimes seen to be broken up into granules (chromosomes), apparently fourteen in number, contrasting in this respect with *H. muscae-domesticae*, in the nucleus of which eight chromosomes are present (Prowazek). The blepharoplast is oval or kidney-shaped, of a large size, and stains deeply. It is placed close to the origin of the flagella, and to the anterior rounded extremity of the body of the parasite. The double flagellum arises close to the blepharoplast and may reach an enormous length in some individuals (fig. 4).

Besides these large forms, smaller individuals are present (figs. 5, 6, 7). The bodies of these parasites stain more faintly than the above and are often curved. The nucleus is more compressed. The blepharoplast is smaller and situated at a greater distance from the anterior extremity of the body. The single flagellum arises close to the blepharoplast, and consequently has a somewhat longer course through the body of the parasite. It emerges as a short, thick, free flagellum.

Both these forms commonly undergo longitudinal division. In some cases the nucleus apparently divides before the blepharoplast.

In the third fly non-flagellated forms were found to occur (figs. 8, 9). Masses of blue-staining protoplasm containing chromatin bodies in pairs (fig. 10) were also rarely found in this fly. Every such pair of chromatin bodies consisted of a larger and a smaller separate portion. The larger portion is circular and more faintly staining, the smaller is oval and more deeply staining. These paired masses of chromatin suggest a form analogous to Leishman-bodies.

On several occasions, in the first two flies, large cells (leucocytes?) were found containing in their interior the broken-up remains of large numbers of the *Herpetomonas* (fig. 11).

PREVENTIVE MEDICINE IN THE ARMY.

By MAJOR A. PEARSE.

Royal Army Medical Corps.

THERE are few subjects which affect an army, as a whole, more than sanitation or preventive medicine, and this is at last becoming fully realised. I use the term "preventive medicine" as I consider it more appropriate and descriptive of this particular branch of medical science, and also because the words "sanitation," "sanitary," "insanitary," convey the impression to the general public of either the presence or absence, as the case may be, of nuisances—a very limited field compared with that covered by the term "preventive medicine," of which "sanitation," as popularly understood, forms a comparatively small part.

Having held the appointment of Specialist Sanitary Officer of a command for more than a year, one has had opportunities and chances of seeing wherein the present system falls short of requirements, and I therefore propose to state briefly the lines which, it appears to me, should be followed before the Service will receive the full benefit of these appointments.

There is a point sometimes forgotten, at least by medical officers, and this is that military considerations *must* come first with a fighting force, be it large or small. Herein lies one of the strongest arguments in favour of preventive medicine. The Army exists to fight, and it is our duty as experts in preventive medicine to advise the officer in command, be he a General or the last joined subaltern, to the best of our ability, how he can best keep his troops healthy and in good fighting trim. A sick and wounded man is only an encumbrance, and the sooner he is got rid of the better for those that are left to fight; with him I do not propose to deal, as it is the duty of the ordinary medical officer to attend him, arrange for his removal from, and ultimate return to, the fighting line. This is not the duty of those who are specially qualified to advise the combatant officer how to prevent sickness, and so to keep his men fit and ready to do their duty when called on, viz., fight and beat their opponent. This raises the question of recommendations, and on this point there is no doubt, I think, that they should be made to the officer commanding direct by the sanitary officer. He (the commanding officer) knows, or should do so, what are the military requirements of the situation. Being informed,

then, what to expect in loss of men from bad surroundings or an unhealthy country, or both, he will be in a position the better to judge whether the risk run of disease will be worth the advantages gained thereby. His is the responsibility to win, and that quickly and with as little loss as possible. To do so he must know all sides of the question. The preventive medicine side of the question he can only obtain from those who have studied such questions and who are specially qualified to give advice on such points.

It is essential that an army to be ready to fight must be organised and trained during peace in the duties it will have to perform during war; this applies to all branches of the Service. Let us take the preventive medicine branch of the Army in peace and see how this applies. Here, under the present arrangements, the sanitary officer makes his reports and recommendations to the principal medical officer. Both are doctors; one has special qualifications and education in the preventive medicine, the other may, or may not, have the same. What is the result if he has not? It is this, that every recommendation made is liable to be so modified as to be rendered useless, or practically so. This is not from any desire to prevent progress, but because the real reason may not be understood, and further, the position that has been acquired by length of service in the Army is considered sufficient to override all else, no matter what are the special qualifications of an expert, if a junior. It is the General who should decide, as it is he who requires his men to be fit and in good fighting trim. But, under such circumstances, how can he know what to do or by whose advice to be guided? A dual control never did succeed and will not do so even in preventive medicine.

Let us see what is the procedure in civil life. A corporation chooses its own medical officer of health, a man specially qualified for the work, and it is to him they refer and on his advice they act in sanitary matters, and not on the advice of other doctors who may happen to be older or to have large practices in the neighbourhood.

So in the Army the sanitary officer should give his advice to his General and not through the medium of another medical officer. To make my meaning more clear, the sanitary officer should be the sanitary adviser of the General Officer Commanding in charge, and not that of the Principal Medical Officer, though the latter could refer to him for expert advice, if necessary, in the same way that any other officer in the command might do. The Command

Sanitary Officer would then be responsible to the General Officer Commanding in charge for sanitary duties in much the same way as the officer in charge of musketry duties, and be attached in like manner to the general staff. By so doing he would hold a definite position on the staff of a command—independent of his own corps for the time being—a point of great importance when performing duties of this kind, and become, as it were, an Intelligence Officer, (Medical Branch). What would be the result of this arrangement? It would be as follows:—

(1) *During War.*—The General would have on his staff an officer who would have made it his special business to become acquainted with the diseases, climate, and people of the particular country in which the war was being carried on. This officer would be able to tell his General before starting on a march, or otherwise, the risks to be incurred by the Army passing through certain places or districts, drinking certain waters, eating certain foods, &c., and the best means of avoiding these risks. The General's attention would not be called to these matters, as is so often the case, only after the mischief was done, by those who were treating the sick, resulting from the want of a few precautions. The sanitary officer would be at the disposal of the General Officer Commanding to go off at a moment's notice with a reconnoitring party, or in any other capacity, to obtain necessary information and then give expert advice, without reference to the Principal Medical Officer of the Force, who may not be near at hand, or be fully occupied with other duties, *e.g.*, administration, visiting hospitals, &c. It might even be found advisable that he (the sanitary officer) should not wear a Red Cross badge on service, as in this position he would probably be called upon to perform duties which would scarcely be permissible under the Articles of the Geneva Convention. Working with the Engineer Officer concerned he would be able to give much valuable assistance in primary selection and arrangements of permanent camps, and, by being specially responsible to the General Officer Commanding in sanitary matters, would relieve the Principal Medical Officer and other medical officers of much work which at present falls to their lot, leaving them free to carry out with greater freedom their duties with the sick and wounded, and also their administrative and corps duties.

(2) *In Peace Time.*—Either at home or abroad the General would have an officer who would, as during war, be available to bring him, first hand, the specialist and expert information he might require about certain localities, buildings, spread of disease,

&c., and thus assist him directly in deciding on the manner in which best to expend the money at his disposal. Under present arrangements, the sanitary officer sends in his recommendations through the Principal Medical Officer, who may or may not send them on or modify them, as he thinks fit, without even suggesting that they are the opinion of an officer specially trained and qualified to give such expert opinion. Let us now consider the qualifications, organisation and *personnel* required to carry out these suggestions. It will be found that they are economical in themselves and that in the ultimate result there will be a great saving of public money, owing to the improved conditions of health of the Army, both in peace and war.

Qualifications of a Sanitary Officer.—(a) It should be a *sine qua non* that the officers holding these appointments should have the Diploma of Public Health of London or some other well-known examining body; (b) he should have been through a course of, or taken a degree, in tropical medicine; (c) the officer should be of active habits, fond of travel, and not afraid of hard work, whether mental or physical, when necessary; (d) if serving at home he should have been abroad previously to India or a colony; (e) if on active service abroad he should, if possible, have served in that particular country previously or have had some special knowledge of the country and its people.

Organisation (War).—(a) One Sanitary Officer (a Colonel or Lieutenant-Colonel) on General Staff of each Army Corps; (b) one Sanitary Officer (a Major) attached to General Staff of each Division; (c) one Sanitary Officer (a Captain) attached to General Staff of each Brigade; each Sanitary Officer to have one trained assistant (private or corporal of Royal Army Medical Corps) with him; (d) the medical officers of units to be responsible for the removal of nuisances from, cleanliness and general sanitary condition of, their particular lines. For this purpose one man per company and one non-commissioned officer (a corporal) to be detailed by the officer commanding of corps or regiment; this non-commissioned officer and these men not to be relieved of this duty without reference to the medical officer, except in case of great emergency; (e) correspondence and reports on sanitary matters to pass to sanitary officers concerned, direct, for the information of the General Officer Commanding, and not through the Principal Medical Officer.

In Peace Time.—(a) One, or in large commands (as in India), two Sanitary Officers (a Colonel or Lieutenant-Colonel) attached to the General Staff of the Command; (b) two or four laboratory

assistants (Royal Army Medical Corps) as the case may be; (c) a medical officer in each division (a Major) and brigade (a Captain) to supervise the general sanitary arrangements of such division or brigade, and if possible, to be the officer who, on mobilisation, would be the Sanitary Officer of that Division or Brigade; (d) the medical officers of regiments or corps where such exist, and those in charge of depôts or other small stations; (e) one man per company and one non-commissioned officer of regiment or corps concerned to work under medical officer for cleanliness of, removal of nuisances from, and general sanitation of barracks or camps.

Lastly.—The name "Sanitary Officer," would, I think, be changed with advantage. At present it is suggestive to the general public and most officers of the "Sanitary Inspector" of civil bodies. There is, of course, no connection between the two—the Army sanitary officer being highly trained and qualified in a special branch of the medical science, the other simply an inspector of nuisances working under the orders of the medical officer of health. Such names as Army Health Officer, Travelling Health Officer, Intelligence Officer (Medical Branch), Staff Officer for Army Health, Staff Health Officer, Staff Officer for Preventive Medicine, would be much more descriptive of, and suited to the duties performed by, these officers in the Army.

Such, I think, are the lines at present indicated for future development of this important branch of the Service, and which, if carried out, will, I am convinced, be to the advantage of all concerned.

SOME UNCLASSED PARASITES WHICH AFFECT THE SOLDIER IN INDIA.

BY LIEUTENANT-COLONEL J. FALLON.

Royal Army Medical Corps.

THIS short sketch will hold no news for those who know India, but may interest those who have yet to go there.

Ships that voyage in the Tropics soon collect weeds and barnacles on their hulls; the soldier is not long in India until he finds he, also, has gathered on him a number of parasites which make a lodgment on him, or rather, a living off him. All parasites may not be hurtful; unfortunately, the soldier thinks his are all good fairies, and wonders how he ever got on without them before. One soothingly shaves him daily, and gives him cycosis occasionally. Another will bring him his ginger beer, and even opens it for him with a dirty finger, or a piece of stick picked out of the nearest gutter; and so on, with many others to be mentioned below.

Suppose we take a unit that has been a fair time in India, and see what accretions can grow round it, and what usages may come to be established in it. Say a soldier has to turn out early, and the coffee shop or other arranged place for "gun-fire tea" is at some distance, he has an obliging native at hand with hot cocoa on sale for a trifle. Where or how prepared may take some finding. The soldier comes back to breakfast, and is inclined for something more than bread and tea. The coffee shop is still a way off, but he rubs his ring, and at his elbow is a native retailing hot porridge, again for a trifle. The dinner hour comes round and the meat has proved uneatable (as it often does, unfortunately); with what shall he fill up the vacant place? Once more the obliging native is at hand, this time with hot rice pudding, as mysterious in its origin as its predecessors. The afternoon wears on, and supper is still far off. Rice pudding fills for a time, but does not last. The good fairy comes again to the rescue with boiled peas, or that still more succulent and tempting snack, the "Bombay oyster." For the benefit of the unlearned I may say that the "Bombay oyster" is a raw egg, vinegar and pepper. The latter is not always necessary; Keating's insect powder may be used at a pinch. This mixture is served out in the solitary glass the hawker carries, and it must not be imagined that this glass is cleaned each time—it is not. No doubt many other petty caterers are known to those with more

Indian experience, or, perhaps, some are lucky enough to have never met any of these.

In these days, when we have to seek for other sources of sporadic enteric than the controlled water and milk supplies, this question has a very serious side. The soldier is over-supplied with natives, particularly in stations where he has extreme heat to bear. Generally low-caste, unclean beings, they are always at his hand, attending to his wants and, as has been seen, furnishing him with "dainties." As well as shutting the big gates against enteric, these small postern doors have also to be looked to. It is not so easy as it seems to stamp out these trades. The soldier likes these people about him. The old soldier often finds that his snacks come cheaper than if he used his institutes; the young soldier has the feeling of his importance fed, by having retainers at call. Of course this must be qualified. Probably the majority of men get all their extra food in their institutes, but there is a large minority who patronise these folk. In the next place the spending power of a unit is sometimes not realised. A penny per day per man, in a fairly strong battalion, may amount to £120 a month, or more. So it can be seen how large a sum may be circulated among these hangers-on. The small sums these latter pick up, and which we see may become a large amount in the aggregate, have to yield their toll to whoever is strong enough to exact it, and so vested interests grow up which offer passive resistance to remedial measures.

Another qualification is now necessary. I am far from implying that the above would fairly represent an average unit in India. Whether these customs prevail in many or few I do not know. I do know, however, that I have not drawn a fancy picture.

In passing, though it has only a distant connection with the above, I may note the liking I find among soldiers to make themselves independent of their institutes in the matter of food. They say that they economise by it. Many of them club together in small groups for the purpose of providing and cooking their suppers. I am told that the practice has considerably grown since the South African War. It is sometimes difficult to decide whether it should be frowned upon or let alone. The skill to cook for himself is a valuable asset to the soldier in the field. On the other hand, as the cooking is generally done in the open, it is, so far, exposed to contamination by dust and flies; the men may not be careful where they procure their materials from, and these materials may be overmuch handled by natives. It needs careful watching and regulating at all times.

RÔLE AND TRAINING OF THE ROYAL ARMY MEDICAL CORPS MILITIA.

BY CAPTAIN S. T. BEGGS.

Royal Army Medical Corps (M.).

PRESUMING that the Royal Army Medical Corps Militia are for the purpose of taking the place at home of the Royal Army Medical Corps in time of emergency, it follows that their training should in all respects be carried out on the lines of the Royal Army Medical Corps. The question which therefore arises—can this be accomplished in twenty-seven days' training annually?—presents insurmountable difficulties, especially when the class of recruit which forms the material is taken into account, and the wastage which is continuously going on from men enlisting into the regular forces, &c. It is evident that a nurse, a non-commissioned officer, a clerk, a cook and a compounder, cannot be made in twenty-seven days, and to even attempt to partially train a man in any of these specialities in the time allotted is a waste of public money. The training should be considered the time for recapitulation of duties already performed, and for refreshing the memory in facts already taught. And even here it will be found that a satisfactory result will only be gained in dealing with men who have already had a thorough training. A man who shows an aptitude for nursing should be attached to a military hospital for a special course of instruction in nursing duties, and at the conclusion of the course, be examined as to his capabilities and fitness in the same manner as for a cook, &c., during non-training periods. A man who becomes a non-commissioned officer has no experience in the hospital duties of his rank, after passing for promotion at Aldershot, and these cannot be taught during twenty-seven days' training. A special course of instruction in these duties is therefore necessary, in order that these non-commissioned officers may be able to replace a wardmaster, a steward, a clerk, &c., in a military hospital, in time of emergency. After having passed such a course satisfactorily, the annual training can be judiciously made a time of refreshment in such special duties. With regard to compounders of medicine, nothing is to be gained by putting a man who enlists into the militia through a prolonged and expensive course in compounding; but here no difficulty should exist in obtaining a sufficient number of chemists' assistants who would be willing to enrol, and

to hold themselves available for duty in military hospitals in the district in the time of emergency. Such civilian compounders should form part of the establishment of the district company, Royal Army Medical Corps Militia. The same would apply to hospital sisters and nurses, who would similarly form part of the establishment. A company quartermaster is required to act during emergency, who could most probably be found in a retired quartermaster, Royal Army Medical Corps. The Royal Army Medical Corps Militia officers require the same training in every department of a military hospital as is given to a Royal Army Medical Corps officer. To this end it is considered that he should have the training of his own non-commissioned officers and men in hospital duties, which does not obtain at present. Civil surgeons who have been trained in military hospital routine should also be borne on the establishment of the district company, Royal Army Medical Corps Militia. In order that a unit of the Royal Army Medical Corps Militia can effectively replace the Royal Army Medical Corps in a district, it must be a self-contained unit. As regards the establishment, as each unit of the Royal Army Medical Corps is allotted to a particular district, its establishment should be based on the requirements of the district, and not on a fixed numerical basis apart, as is at present laid down. Its *personnel* in orderlies of the nursing, general duty, clerical and cooking sections, in non-commissioned officers, in compounders, in nursing sisters and in medical officers, should be calculated on the number and size of the hospitals to be manned. A record office for each district company is required, and the officer in charge of records should be the officer commanding the company.

Clinical and other Notes.

NOTES ON A CASE OF A RARE FORM OF VOLVULUS.

BY MAJOR C. B. LAWSON.

Royal Army Medical Corps.

GUNNER W., R.G.A., aged 26, service six years and two months, reported sick on December 18th, 1905. He stated that he had had a sudden attack of griping in the abdomen during the previous night, and that on getting out of bed he had fainted, and bruised and cut his face. He was admitted to hospital on the following morning at 9 a.m. He complained of pain in the abdomen, and said that his bowels had been opened twice during the day. His temperature was 99·4° F. During that night the abdominal pain became worse and hot bottles were applied to relieve the pain, after which he slept.

On the 19th there was abdominal pain all day. Patient took a pint of milk during the day, but vomited in the afternoon. An enema was given at night, from which a large constipated stool resulted. A quarter of a grain of morphia was given at night; he slept a little, but was awake a good deal, and complained of severe pain, and vomited again in the early morning. At eleven o'clock his condition was as follows: Patient was lying on his right side, with his knees drawn up, and in evident pain. His temperature was 100° F., and pulse 70 and regular. His breathing was rapid and shallow and practically entirely costal. The abdomen was distended; the left side being very rigid and somewhat dull to percussion; the right side was less rigid and hyper-resonant. The heart and lungs were free. Tongue dirty and covered with a whitish-yellow fur. The expression was not pinched. Major Lawson was then called in consultation. Examination *per rectum* disclosed nothing abnormal. The urine was small in quantity, high coloured, acid, and the specific gravity was 1048; there was no albumen, sugar or deposit. After 7 p.m. there was no more vomiting. Belladonna fomentations and, later, turpentine stupes were applied to abdomen. Four minims of liq. strych. hyd. were given hypodermically every sixth hour. Pulse 78. Large enema of two and a-half pints was given with no result; the giving was accompanied by great pain.

On the 21st, at 1.30 a.m., his face was rather pinched. The pain was less; the pulse 96 and temperature 100·8° F., the abdomen being much more rigid. At 9.30 patient had vomited several times, the vomit being of a greenish colour, but not faecal. The pulse was 116. Preparations for operation were made in the usual way. Five minims of liq. strych. hyd. were given hypodermically, and an enema of one ounce of brandy

and two ounces of Brand's essence was given before being taken to the theatre. The case was then handed over to Major Lawson.

(Signed) L. BOUSFIELD,
Lieutenant, R.A.M.C.

This case was taken over December 21st, 1905.

At about 11.30 a.m. yesterday I examined the case and found his condition as follows: He was lying in bed on his right side, head and shoulders slightly raised, and his knees drawn up. He looked in pain, which he stated was severe and in his abdomen (he pointed to the left lumbar and iliac regions); the right side of his face was severely abraded, and he spoke in short, gasping sentences. Although his expression was anxious and that of pain, there was no sign of the Hippocratic facies. The abdomen was distended and his respirations chiefly thoracic, the left lumbar and iliac regions remaining quite fixed, even on deep inspiration. Palpation showed that the above regions were very rigid but not very tender; they were somewhat dull, while the right flank was hyper-resonant and slightly rigid. Movement did not alter the position of the dullness. He had passed urine. Rectal examination was negative. Heart and lungs showed no signs of disease. Tongue not flabby or tremulous; it was coated with a brownish-yellow fur, but was fairly moist. Pulse 70, regular, and of moderate tension and fair volume. Temperature 100° F. The question of exploratory laparotomy was discussed, but it was decided to wait and watch the case for the following reasons:—(1) The history was confusing: There was a suggestion that he had been drunk the night he was taken ill, so he might have sustained a contusion of the abdomen, and there might have been a localised paresis of the intestine; (2) his bowels had been well opened and he had passed urine naturally, and, with the exception of the high specific gravity (1048), nothing abnormal was found in it; (3) similar conditions have been met with in Mediterranean fever; (4) paralysis of the colon could account for all the symptoms. The abdominal condition also resembled localised simple peritonitis, but that in itself does not, of course, call for operative interference.

I saw the patient again at 6.30 and his condition was the same. He had not vomited. A soap and water enema of two and a half pints had produced no result. I ordered turpentine stupes to be applied to the abdomen, and four minims of liq. strychn. hydrochlorid given hypodermically every sixth hour.

At 9.30 this (December 21st, 1905) morning I again saw the case, and the patient's condition had quite altered. His face was drawn and pinched, and slightly jaundiced. The abdominal pain had almost gone and the tenderness greatly diminished; but his pulse was 116 and running; his temperature was 99° F. He had vomited twice some greenish fluid, not faecal. I was told that "at 1.30 a.m. his general condition was

worse, and that he had developed the 'abdominal face'; his pulse had risen to 96 and become wiry." The whole abdomen was now rigid. He was prepared for operation. Catheter passed. Stimulating and nutrient enema ordered; also a hypodermic injection of five minims liq. strych. hyd. Lower limbs wrapped in cotton wool and flannel bandages.

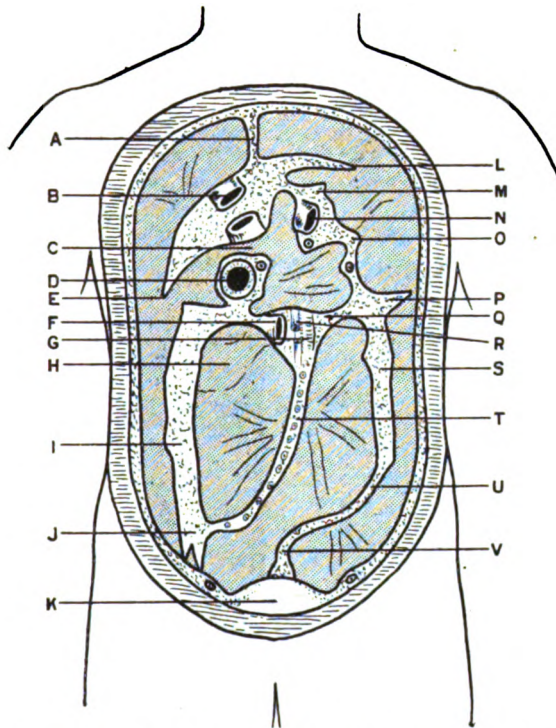


DIAGRAM A.—To show lines along which the peritoneum normally leaves the abdominal wall to invest the viscera. A, Falciform ligament of liver; B, vena cava; C, foramen of Winslow; D, duodenum; E, right lateral ligament of liver; F, duodenum; G, aorta; H, duodenum behind peritoneum; I, bare surface for ascending colon; J, commencement of colon; K, bladder; L, left lateral ligament of liver; M, gastro-phrenic ligament; N, oesophagus; O, gastro-splenic omentum; P, costo-colic ligament; Q, transverse meso-colon; R, superior mesenteric artery; S, bare surface for descending colon; T, mesentery; U, sigmoid meso-colon; V, meso-rectum.

Operation.—At 11 a.m. the anæsthetic, C_2E_3 , was commenced by Lieutenant Winckworth, R.A.M.C., and the patient was soon sufficiently under its influence. Assisted by Lieutenant Bousfield, a median incision was made through the anterior abdominal wall from a little below the umbilicus to two fingers' breadth above the pubes. On opening the peritoneum some foul-smelling brownish fluid escaped. The region of the sigmoid flexure and the cæcum were examined first, and then the

remaining regions as far as possible. A distended portion of gut occupying the left hypochondrium, lumbar and hypogastric regions was found. The small intestine was not distended. The incision, not being large enough, was extended almost to the tip of the ensiform cartilage, the intestine well exposed, and the following conditions found: The distended portion of gut (starting from the left hypochondrium) consisted of cæcum and ascending colon; they were both purple, and that portion (of the

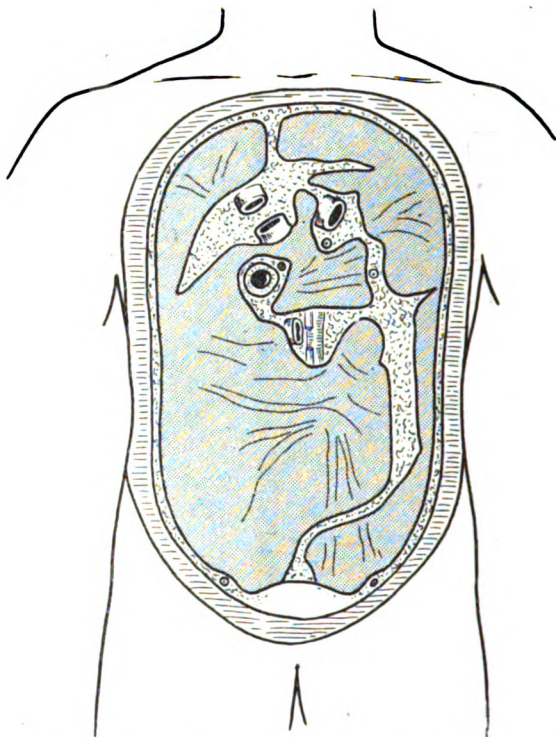


DIAGRAM B.—To show lines along which it left the abdominal wall in the case mentioned in the notes.

ascending colon) in the left part of the hypogastric region was gangrenous and had given way slightly, as air bubbled and hissed up from it when the gut was manipulated. The cæcum was free, but the part of the ascending colon in the lumbar and hypogastric regions was fixed by adhesions. The ileum from the ileo-cæcal valve to Meckel's diverticulum (which, in this case, was about twelve inches from the valve) was purple. On tracing the ascending colon up to the transverse a marked volvulus was found, which it was quite impossible to untwist owing to the adhesions and distension. The condition was soon recognised as hope-

less and did not admit of enterectomy, so the contents of the distended bowel were evacuated and a Paul's tube and drain fixed in, the abdominal cavity irrigated with normal saline solution at 105° F., and the wound edges brought together by silk-worm gut sutures, taking in all the layers in each stitch; three rubber drainage tubes were also inserted and a

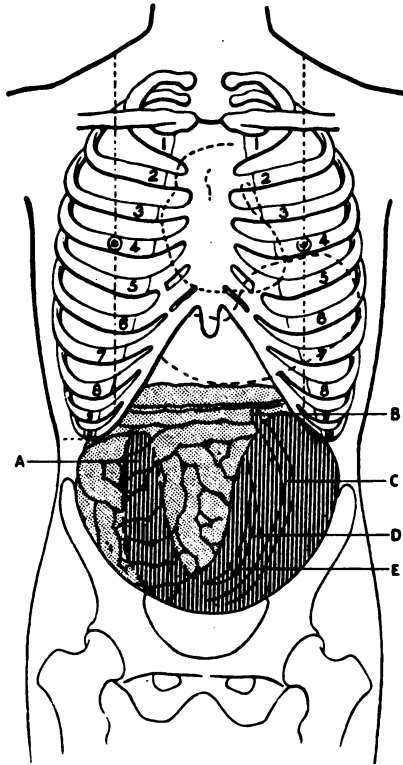


DIAGRAM C.—A, Volvulus; B, vermiform appendix; C, ascending colon; D, gangrenous part, ruptured; E, Meckel's diverticulum.

voluminous dry iodoform dressing applied, so as to allow free exit to the Paul's tube drain. The patient was put to bed, where all was ready and done to minimise shock, of which, however, he died at 7.30 p.m.

Post-mortem Examination.—The adhesions being freed, it was found that the whole of the small intestine, together with the cæcum and the ascending colon, were slung from a common mesentery, the attachment of which to the posterior parietes was a narrow neck giving passage to the superior mesenteric artery, and bounded in front by the transverse colon and behind by the duodenum; there was no trace of mesentery proper as it is found in the normal human body, neither was there a descending meso-colon. The meso-sigmoid was scanty, but the meso-

rectum was fairly well developed (see diagrams A and B for the normal attachment of the mesentery, and that found in this case).

Treves was, I think, the first to bring to prominent notice this condition of the peritoneum, in a paper on the "Anatomy of the Intestinal Canal and Peritoneum in Man," London, 1885, and in the *Lancet*, October 13th, 1888.

The condition is a fairly rare one, and is, of course, congenital and predisposes to volvulus, which, in this case, took place, I think, as follows, and experiments on the cadaver are in favour of my theory:—

Owing to the abnormal mesenteric attachments the small and large intestines were able to float freely about, and when the cæcum and ascending colon were twisted round in front of the small intestine they easily slid back again, but when they were turned up behind the small intestine (as they were in this case) there was a locking, and it can be seen (diagram C) that the loaded cæcum and ascending colon formed a mass leading up to a narrow twisted neck on which lay small intestine, also probably full at the time of twisting, and so spontaneous readjustment was impossible; turning to the right side slacked the twist a little, and may have accounted for the decubitus assumed by the patient, and the symptoms not being more definite. The more distended the cæcum and colon got, the less, of course, was the chance of spontaneous untwisting. It will be seen that the cæcum had revolved from the right iliac fossa to the left hypochondrium. The vermiform appendix, beyond sharing in the general congestion, was normal, but directed upwards and inwards to the right. The congested condition of the lower twelve inches of small intestine was, I think, due to interference with the venous return due to the ileo-colic branch of the superior mesenteric vein being involved in the twist.

I am indebted to Lieutenant-Colonel R. Jennings, R.A.M.C., for his advice during the whole operation, to Lieutenant L. Bousfield, R.A.M.C., for his able assistance, and to Lieutenant H. C. Winckworth, R.A.M.C., whose very skilful and judicious administration of the various anæsthetics enabled the operation to be carried to the extent it was.

AN INTERESTING CASE OF MARGINAL PLACENTA PRÆVIA.

By CAPTAIN D. G. CARMICHAEL.

Royal Army Medical Corps.

Mrs. S., aged 34, multipara, last child four and a half years ago, no abortions in the interval, was recently admitted to the Station Hospital, Rangoon, with a slight uterine hæmorrhage, the patient being eight and a half months pregnant at the time. She was put to bed and kept quiet for a day. The bleeding, which was thought to be accidental hæmorrhage, was not severe, and under treatment ceased entirely. The next day, forty-eight hours after admission, as all was well, she was allowed to go home

again and was told to keep very quiet. The following day, however, she returned, as the hæmorrhage recommenced, later becoming severe. On examination, the os would not admit one finger, but as unavoidable hæmorrhage was strongly suspected, the vagina was tightly packed with pieces of gauze. These were left in for some ten hours and the patient carefully observed; at the end of this time the plugs were removed and the patient examined again. The os now admitted two fingers, the occiput was presenting and the margin of the placenta could distinctly be felt. The hæmorrhage, on removal of the plugs, became very severe; I, therefore, determined to put her under chloroform and turn at once. The patient was put completely under the anæsthetic, and as soon as the uterus was sufficiently relaxed bipolar podalic version was performed, the hæmorrhage at this stage being most alarming, for the blood was pouring out almost like a tap of water. The turning having been successfully performed, a foot was brought down with great difficulty, since the os would only admit two fingers and the parts were extremely slippery, due to the blood. As soon as the foot was brought well down so that the child's thigh plugged the os, the hæmorrhage ceased entirely. The patient was left with the foot protruding at the vulva, with a cloth soaked in antiseptic wrapped round the child's foot to prevent it from slipping back, and carefully observed. A few hours afterwards uterine contraction began and a still-born child was delivered ten hours later as an ordinary breech case. The placenta was born within half an hour and it was then seen that a secondary placenta (*placenta succinturiata*) had probably been the cause of all the trouble. This secondary placenta, about 9 inches in circumference, was quite distinct from the primary, an interval of 2 inches separating them, with the membranes intact between. The child, which had been dead for some hours, showed a deep depression round its thigh, indicating how strongly it had been pressed upon by the os. An antiseptic intra-uterine douche at 120° F. was given. The puerperium was normal from beginning to end, and on the tenth day the patient left the hospital. It is interesting to note that there was no secretion of milk, and that the patient began normal menstruation two months later and is now in excellent health.

A CASE OF GENERAL PERITONITIS FOLLOWING ABSCESS OF THE LIVER.

BY LIEUTENANT T. J. WRIGHT.

Royal Army Medical Corps.

PRIVATE T., Manchester Regiment, was admitted to the Station Hospital, Wellington, on April 5th, 1906, with the following history:— During his fifteen months' service in India he has had dysentery on two occasions, neither of which, he states, was sufficiently severe to render him unfit for his duty. He has been a heavy beer drinker. His present illness began on March 27th, a week before admission, with dysentery,

which lasted three days. On April 2nd he began to suffer from headache, loss of appetite, and a feeling of weight and fulness in the right hypochondrium.

Condition on Admission.—Patient lies on his back, with face flushed, eyes bright, conjunctivæ somewhat bile-tinged, tongue dry and brown, bowels confined, temperature 101° F.; he says he feels comparatively well, with the exception of a dragging sensation in the right hypochondrium; urine normal, heart and lungs healthy. Liver is enlarged about an inch and a half below costal margin, but—there is no enlargement in an upward direction—pain is elicited on deep pressure, most marked at the costal margin in the nipple line. Patient was placed on plain milk, fomentations were applied over liver, and ten grains of ammonium chloridum given internally three times daily. During the next forty-eight hours his condition showed no improvement; the liver enlarged another inch below costal margin, and the pain and tenderness, although more localised, became more severe. On a blood count being made, a marked leucocytosis was found to exist, on account of which, together with the clinical aspect of the case, patient was given an anæsthetic, and on aspirating through the eighth intercostal space, mid-axillary line, a small abscess was discovered in the right lobe of the liver, which was opened, drained, and a tube inserted. Patient's progress, after this operation, was satisfactory for eight days, at the end of which he began to complain of cramp-like pains in the abdomen, which were chiefly felt round the umbilicus. On examination, the abdomen was somewhat full and tympanitic, but there was no marked tenderness. During the next three days patient's condition gradually became more grave, pulse increased in frequency, and all the symptoms of general peritonitis developed.

Operation was decided on, and as the rigidity and tenderness was most marked over the region of the cæcum, Lieutenant-Colonel G. Cree, R.A.M.C., opened the abdomen by a vertical incision through the right rectus sheath, when a quantity of bile mixed with thin sero-pus escaped. The peritoneum was much congested, the large and small intestines were distended, and of a dark red colour, and the tissues very soft. On the fingers being passed to the back of the cæcum a long gangrenous appendix was felt, and with difficulty freed from adhesions and brought to the surface; as patient's condition at this stage of the operation became very weak, the appendix was hurriedly removed, and the abdomen, having been thoroughly flushed out with hot normal saline solution, two long strips of gauze were inserted, one reaching to the inferior border of the liver, and the other well into the right iliac fossa. The abdomen was then stitched up. The day after operation, under an anæsthetic, the gauze plugs were removed, the abdomen was again washed out with saline solution, and rubber drainage tubes were inserted. This washing out of the abdomen was continued daily for three days, at the end of which the returning fluid became quite clear; patient has made an uninterrupted recovery, and was discharged from hospital on June 8th, 1906.

Remarks.—The chief interest in this case, I think, lies in, What exactly was the cause of the general peritonitis?

I am inclined to think it was due to a fistulous communication between the liver abscess, which was quite superficial, and the peritoneal cavity, the condition of the appendix being probably part of the general peritoneal inflammation. The existence of leucocytosis I have found to be of the greatest value in helping to diagnose liver abscess in its earliest stage, more especially as our great pus indicator, the pulse rate, is usually masked by the presence of bile in the general circulation.

NOTES ON A CASE OF EXTENSIVE FRACTURE OF THE SKULL, FOLLOWED BY MIDDLE MENINGEAL HÆMORRHAGE.

By CAPTAINS A. H. WARING AND W. C. CROLY.

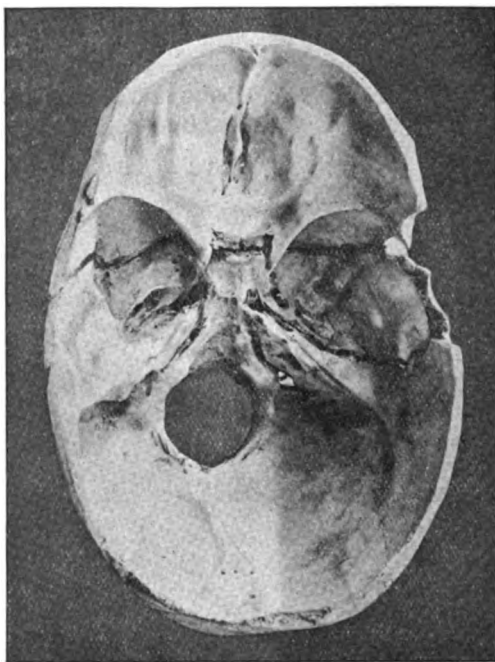
Royal Army Medical Corps.

THIS was a case of a sergeant, aged 29, who was thrown from his horse on September 23rd, 1904.

An onlooker gave the following account of the accident: "Sergeant L. was cantering on the grass when his horse swerved to the off side and the rider lost his balance, but clung with his right arm around the horse's neck, then fell just in front of the horse, striking the ground with his left shoulder and left side of head; the horse kicked him as he reached the ground." When I (W. C.) reached the patient, about ten minutes after the accident, I found him lying on the ground in a semi-conscious condition and breathing heavily, blood trickling from both nostrils and from mouth; slight bleeding also from right pinna. Patient was restless and trying to sit up, and his friends were restraining him. He could not be roused sufficiently to answer questions. It was noticed that in his attempts to rise his left arm and leg remained motionless, but right limbs were free. Pupils even, slightly contracted and fixed. A large, pulpy contusion was found extending from the right parietal eminence downwards and forwards towards the right ear; he also had ecchymosis of right eye. No escape of cerebro-spinal fluid. Pulse full and about 80 per minute. His friends stated that patient vomited blood once shortly after the accident.

On arrival at hospital patient was placed in bed, calomel administered, and bladder attended to. On examining his mouth blood was seen trickling down the sides of the pharynx. Breathing now was stertorous; pulse full and about 60 per minute. He had paralysis of left arm and leg; pupils equal, dilated and fixed. The case was seen by Captain A. H. Waring in consultation, and shortly afterwards by Lieutenant-Colonel T. Daly, Senior Medical Officer. It was decided to trephine over the anterior division of the right middle meningeal artery, so patient was placed on the operating table without further delay.

Operation.—A semi-lunar flap was turned up, the centre of which was one and a half inches behind the external angular process, and one inch above zygoma. Severe hæmorrhage took place as the knife penetrated the muscle, and these vessels were secured and tied. When the bone was laid bare a fissured fracture was seen in the anterior portion of the wound, from which blood welled up freely. The pin of the trephine was applied just behind the edge of the fracture, at a point two inches behind and two inches above the zygoma, and a crown of bone removed, showing on its inner surface a small groove. Many dark clots were removed



through this opening, but the artery could not be seen or felt, so the opening was enlarged for half an inch downwards along the line of fracture, but the artery could not be found. Another crown of bone was then removed with the trephine just posterior to the first ring, and again numerous dark clots were removed by irrigation, but still the artery could not be seen or felt. Patient's pulse became very feeble and breathing very heavy, so it was decided to proceed no further. Apertures were plugged with gauze and the patient put back to bed. The pulse improved, but the respirations became slower and more laboured, and the patient died in eight hours. There was but little oozing into the dressings when they were removed after the patient's death.

Post-mortem.—On removal of the skull-cap meninges and brain were found intact. On removal of the brain a fracture was seen extending from two inches below and in front of the right parietal eminence downwards and forwards through squamous portion of temporal, through greater wing of sphenoid and body of that bone, between anterior and middle clinoid processes, right across base of skull in practically the same line, to the mid-point of the left squamo-parietal suture. A second fracture, V-shaped at its upper end, encircling the right parietal eminence, ran almost vertically downwards to the suture between squamous and parietal bones, followed this suture backwards for about half an inch, then ran vertically downwards through squamous into external auditory meatus, and then forwards and inwards to foramen lacerum medium, traversing the glenoid fossa. The right malar bone was fractured at its frontal and temporal processes. On examining the calvarium it was noticed that the groove in the parietal bone for anterior branch of middle meningeal artery was about the size of a quill on the left side, but on the right side the groove could barely be made out, and the artery itself was demonstrated with difficulty. On replacing the crown of bone from the first trephine opening the groove noticed at the time of operation on its inner surface was found to correspond with the groove for the anterior branch of the middle meningeal artery. The chief points of interest about this case seem to be :—

(1) The operation bore out the belief that the fracture was extensive, and that the middle meningeal artery was ruptured.

(2) That, owing to sudden collapse of the patient on the table, further operative measures, such as tying of external carotid, were not justifiable.

(3) That, though the artery was not found and tied at the operation, the bleeding practically ceased after plugging the trephine openings with gauze.

(4) The inability to find the torn artery on the right side at autopsy owing to hæmorrhage and the small size of the vessel.

The accompanying photograph of the skull serves to demonstrate the extent of the fracture.

A CASE OF RUPTURE OF THE RADIAL ARTERY CAUSED BY A BLOW.

BY MAJOR E. M. MORPHEW.
Royal Army Medical Corps.

LANCE-CORPORAL C., 21st Lancers, was admitted to the Military Hospital, Colchester, on April 19th, 1906. The previous afternoon, while engaged in mounted combat, he received a blow from a sabre on the right forearm. Owing to excitement he took no notice of it, but a minute or so later he received another blow, which caused a contused wound on

the outer and posterior side of the right wrist, and necessitated his discontinuing the fight. This wound was sutured; and, at the time, a small swelling was noticed about four inches above the wrist in the line of the radial artery. Next morning the swelling was about the size of a hazel nut; there was distinct fluctuation, but no pulsation, and the forearm was swollen and the skin ecchymosed. On the morning of the 20th the tumour had increased to the size of a small walnut, and the swelling of the forearm was more marked. Fluctuation was visible in the tumour, and could be distinctly felt one and a half to two inches away all round. It being now evident that a rupture of the radial artery had occurred, an incision was made in the line of the artery over the tumour, and after the clots had been turned out and the extravasated blood allowed to escape, the artery was ligatured just above the site of the tumour, traced down for one inch and another ligature applied, and the intervening portion removed; this piece was crushed and had two rents in the coats. The man was discharged to duty on April 30th, 1906.

The points of interest in this case were: (1) that there was no connection whatever between the two injuries; (2) that the wound for which he was admitted was so trivial that admission would not have been necessary had not the other injury to the arm been noticed at the time.

A LITTLE-KNOWN TREATMENT FOR SUNSTROKE.

By CAPTAIN M. F. FOULDS.
Royal Army Medical Corps.

WHILE stationed in Jhansi, India, in 1903, I saw my first case of sunstroke. Jhansi in 1903 was exceptionally hot, the thermometer registering anything from 105° to 115° F. in the shade.

The cases that were admitted were all of the same type, the patient being brought to hospital in an unconscious state; the breathing was deep and stertorous; the skin dry, hot and burning; pulse rapid, and the body temperature between 107° and 110° F.

The patients were stripped and put on a bed in the shade; one man poured water (as cool as could be obtained) from a height; two other men rubbed the body with pieces of ice, and the back of the neck was blistered. An iced-water enema of about two pints was given; a large clinical thermometer was kept under the armpit, and the iced-water enema repeated every ten minutes till the temperature fell to 102° F.

It is the internal active treatment, *i.e.*, iced-water enema, I particularly wish to bring to notice, as I consider the repeated enemas in each case saved the man's life. In that year, 1903, we had nine cases of sunstroke admitted, and all recovered. We also had six or more cases of men brought into hospital with temperatures between 103° and 105° F., complaining of pains in the head and dizziness, and very drowsy, but not

unconscious, and with all the prodromata of sunstroke; all were treated with the iced-water enematas, and left the hospital the following morning feeling quite fit. I advocate this treatment on common-sense grounds, as, when you are hot and want to cool yourself, you call for an iced drink. The patient brought to hospital is generally unconscious, or nearly so, and the iced enematas are much easier and safer to administer than washing out the stomach with iced water.

I also tried the enemata on a case of sun traumatism. The patient had just arrived in the country and had been on baggage guard at the docks in Bombay; his temperature ran up every few hours between 104° and 106·8° F. This lasted during the daytime for five days. The temperature was taken every two hours, and if found rising above 104° F., an enema was given, with the desired result. The patient eventually left the hospital recovered.

Osler, in his short article on Sunstroke (p. 398, 5th edition), says, after advising "packing the patient in a bath of ice" . . . "Ice water enemata may also be employed." Now, we in India do not get ice issued out to enable us to pack each case in a bath, besides giving ice to other serious cases in hospital; this is another argument in favour of the iced enemata, as it takes very little ice to cool a quart of water.

Manson, in his account of Siriasis, says: "Unless active measures to lower temperature are taken early in the progress of the case, and unless the measures are vigorously carried out, in the great majority of instances death will occur within a few hours, or even minutes, of the onset of insensibility." He does not mention enemata at all, but advocates Chandler's external treatment. This treatment in India could not be carried out in the majority of stations, as the ice has to come from a distance, and the scale allowed out here is very small.

I should also very much like to know whether this treatment is successful in cases of hyperpyrexia, of rheumatic and scarlet fevers, hysteria and tetanus, &c., and hope that officers who try this active internal treatment will announce successful cases.

The statistics for sunstroke from 1900 to 1903, show a very high percentage of deaths:—

	Remaining from previous year				Admitted into Hospital		Died in Hospital		Died out of Hospital		
1900	2	..	..	174	..	..	40	..	12
1901	1	..	..	157	..	..	37	..	9
1902	1	..	..	171	..	..	46	..	8
1903	0	..	..	307	..	..	54	..	15

If this internal active treatment were known to officers newly arriving in this country, the case mortality would show a marked decrease.

I do not claim this as my original treatment, as it was shown to me by Captain W. A. Heppollette, Indian Subordinate Medical Department.

CASE OF HEPATIC ABSCESS WITH RUPTURE INTO THE RIGHT PLEURAL CAVITY.

BY CAPTAIN G. A. K. H. REED.

Royal Army Medical Corps.

APRIL 15th.—The case came under my care at the Station Hospital, Jhansi, on this date. The previous history, as gathered from the clinical notes, was, briefly, as follows :—

February 20th.—Patient was admitted into hospital, with soft chancre, on February 8th; he was otherwise in good health. On this date (February 20th) he had a sudden attack of hepatitis; his temperature rose to 102° F. He complained of pain in the right shoulder and over the liver; there was tenderness on pressure under the right costal margin, and the hepatic dulness was increased.

Treatment.—Amon. chlor. grs. x., mag. sulph. ʒi., t. d.; hot fomentations locally. For the next few days the temperature rose to over 100° F. in the evening, but was normal every morning.

February 23rd.—Patient's condition became worse; the temperature rose to 102·5° F., being markedly intermittent in character. The respirations were 35, bronchitic sounds were heard over both lungs, and there were signs of consolidation at the right posterior base.

February 25th.—Effusion took place into the right pleura, extending up to the sixth rib in front and behind. The hepatic pain and tenderness unaltered. Temperature 103° F., remittent; respirations shallow, 44.

March 1st.—The effusion began to subside, but the hepatic symptoms became rather more severe. From the 24th to the 26th ultimo, the temperature rose gradually to a maximum of 103·5° F. For the last few days there was an average of 100° F. in the morning and 102° F. in the evening; average respirations, over 40.

March 2nd.—Effusion much less. Bronchitis subsiding. Liver and spleen both palpable. No jaundice. Sputum, white and tenaceous.

March 4th.—Temperature became normal. Effusion became absorbed, but hepatic symptoms persisted, though in a less degree. From this date to March 24th patient improved rapidly, the effusion disappeared, and the hepatic symptoms subsided, though the liver was still enlarged. The pulse and respirations dropped to normal, and he was allowed up on the 21st.

March 21st.—Symptoms suddenly became acute; patient had a rigor; his temperature rose to 102·4° F.; the pain and tenderness over the liver became suddenly severe. The diagnosis of hepatic abscess was made, and he was prepared for operation.

March 27th.—The liver was explored through the ninth space in the posterior axillary line; pus found; the abscess opened and a double drainage tube inserted, the temperature dropping to normal. The drainage on the following days was free at first, but later the discharge decreased in amount; consequently the temperature rose.

April 10th.—A longer tube was pushed in, a large amount of the characteristic pus escaped, and the temperature again fell. The discharge was then free for two days, and the general symptoms subsided.

April 12th.—The temperature began to rise again; his general condition was, however, fairly good, and he took his nourishment and slept well. There was no history of dysentery or chronic diarrhœa. He had a slight attack of hepatitis last hot weather, but had completely recovered from it.

Examination.—Patient was a sallow, thin subject, and had evidently been losing flesh rapidly; he had slight "lemon tinting" of the conjunctivæ, but no definite icterus. He complained of very severe pain over the liver; percussion causing great agony. *Temperature*, 99° F. *Pulse*, 112, soft and compressible. *Respirations*, 38, shallow and evidently painful, especially on right side. *Tongue*, coated. *Urine*, normal. *Heart*, normal, displaced three-quarters of an inch to the left. *Lungs*: *Left*, no adventitious sounds, movement exaggerated. *Right*, immobile (except at apex). There was a large area of the lung, the upper limit of which reached the fifth rib in the axillary line, sloping down in front to the sixth in the nipple line, and behind to the seventh in the scapular line, which was dull, with total loss of vocal resonance and fremitus and breath sounds.

Treatment.—Ammon. chloride, mist. alba. Brandy; milk diet. Tube was tied into wound, as it tended to slip out.

April 17th.—Patient became rather weaker; temperature came down to normal; pulse rather softer; discharge from tube more profuse. Signs of fluid in pleura unchanged.

April 19th.—*Second operation.* Under chloroform the pleura was aspirated through the seventh space in the scapular line, and typical liver pus was withdrawn. The intercostal space was then freely incised, air rushing in, and about a pint of liver pus evacuated. A large drainage tube was inserted and tied in.

April 20th.—Free discharge from the pleural opening, but none from the older wound. To be dressed three times a day. The temperature dropped, and the general condition for the next few days was much improved.

April 26th.—Free discharge from pleura, but patient's general condition worse; he was very weak, with a small, rapid pulse and rising temperature. He complained of excruciating pain just above the right costal margin in the nipple line.

April 27th.—Under chloroform, the liver was aspirated in the nipple line at the seat of pain, just above the costal margin, and pus found at a depth of four and a-half inches; as drainage would not have been free in this situation the needle was cut down upon from the eighth space in the posterior axillary line; the new abscess reached and a large tube tied in. This second abscess had, at the time, no connection with the one

previously opened, but was connected with the pleura, as syringing demonstrated.

April 29th.—Dressed four times a day; copious discharge from the pleura and last opened abscess, but none from the original operation wound. Syringed out with hot boric lotion twice a day. Ordered a mixture containing liq. strychninæ and sal. volatile.

April 30th.—Several pieces of liver substance came away in the discharge, which is very profuse; the organ is evidently breaking down.

May 1st.—Condition very grave; sloughs of the liver continue to be discharged; the pus was rather offensive. Temperature taken on a "hectic" character. Stimulants increased.

May 4th.—Discharge free and offensive. Patient was much weaker.

May 6th.—There was a temporary improvement in his general condition.

May 7th.—Temperature since the 4th had been normal, due to collapse. He became gradually weaker, and died on the 12th, at 7 a.m.

May 12th.—At the autopsy a large abscess cavity was found, occupying nearly the entire right lobe of the liver. Its upper boundary was formed by the lower surface of the lung, which was involved in the inflammatory process, and by a distinct line of adhesions, between the lung and parietal pleura. The walls of the abscess were greenish, sloughy and friable. The loculated appearance suggested the coalescing of several small abscesses by a gangrenous process. Round the abscess the liver was adherent to the diaphragm, but not adherent to the abdominal parietes. On removing the liver a large ragged opening was found in the diaphragm about three and a half inches in diameter. The lung was adherent to the diaphragm along the margins of the opening. The upper part of the pleural cavity above the line of adhesions was healthy. The opening made into the pleura on April 19th entered the abscess cavity just above the margin of the diaphragm; the two other openings entered the cavity at its lower limit. The liver was somewhat enlarged. On section, there was a zone of congestion, about two inches deep, surrounding the abscess cavity. *Heart*, normal, displaced three-quarters of an inch to the left. *Lungs*: *Right*, almost the entire lower surface forming the "roof" of the cavity was solid to the depth of an inch, the surface being sloughy and friable. The lower half of the basal lobe was congested. The middle and upper lobes were normal, as was the pleura covering them. The larger tubes showed catarrhal inflammation. *Left*, normal; some compensatory emphysema along its anterior border. *Spleen*, enlarged and congested. *Intestines*, normal; there were no traces of antecedent dysentery. *Other organs*, normal.

The chief points of interest about this case were: (a) The absence of a history of dysentery, the *post-mortem* confirming this. Circumstances, unfortunately, prevented the examination of the pus for *amœba coli*. (b) The preliminary pleurisy with effusion, caused, no doubt, by direct

extension from the inflamed liver, and its complete resolution. (c) The subsequent period of apyrexia for over three weeks, during which time the abscess must have been forming. (d) The insidious extension of the suppurative process to the pleura. (e) The great severity of the inflammatory process locally.

I regret that I did not immediately explore the liver again, after finding the empyema, but it was thought that the "peccant" abscess was the one previously opened, the temporary improvement following the operation seeming to support this view.

A CASE OF SIMPLE FRACTURE OF THE VAULT OF THE SKULL.

By MAJOR J. S. EDYE.
Royal Army Medical Corps.

ON May 22nd, at Meerut, Bengal, Lieutenant S. was galloped into, at polo, with tremendous force, the two ponies and riders rolling over and over. Lieutenant S. never left the saddle and was lying on his back on his pony's loins, with his head on his pony's quarters, and before I could get hold of the officer's head and shoulders, and jamb my leg against the pony's quarters, the pony gave two more rolls off and on to Lieutenant S.'s head and shoulders, crushing the head between his quarters and the ground.

The patient was quite unconscious, with stertorous breathing and violent vibrations of the *right* arm which lasted for about two minutes; by which time his leg was cleared from under the flap of the saddle, and we had carried him back a yard or two. He then became deeply cyanosed and appeared to be dying. This condition, however, somewhat improved, and getting him into a dhooly, I went with him to the hospital, about a mile off, sending on ahead to have an officer's ward opened. When nearly there, he again became deeply cyanosed, and I then thought him dead.

On placing the dhooly on the verandah I made the pulse out again—44 beats to the minute—and the cyanosis passed off; I let him rest for an hour, fanning him awhile. He was then lifted on to a bed, and for the next fifteen minutes he was very sick.

During the following half hour he lay quite still, the pulse falling to 40 beats in the minute; I gave 2 drachms of brandy in some water and the pulse returned to 44. He was wearing a sola topee at the time of the accident, but without cross bands inside; the crown was completely crushed in and the front and left side of the brim broken downwards.

His forehead, left eye, elbows and shoulders were much contused. At 10 p.m. he was given 4 grains of calomel in butter on his tongue, and

was ordered a pint of milk for the night; I then noticed a conical swelling, the size of half-a-crown or more, over the right temple, and suspected a fracture with effusion of blood deep to the fascia, as there was no discolouration of the skin. The pupils were contracted and equal, and remained in this condition exactly two days.

The next morning about daylight he was semi-conscious, eyes closed, temperature 100.4° F., pulse 64; the swelling over the right temple "pitted" on pressure, but there was no discolouration; on the opposite side there was some boggy swelling—pitting on pressure—but over a larger area. No discharge from the ears or nose; bowels not moved. He had taken his milk well, and a good deal of iced soda water. It must be remembered it was the middle of the hot weather, the temperature varying from 103° F. to 109° F. in the shade. An enema was given which acted well, and his temperature remained 100.2° F. all that day.

On May 24th he slowly tried to put out his tongue when asked, opened his eyes for a moment with a vacant look, and closed them again. The pulse was irregular and weak, varying from 48 to 64 beats in the minute during the quarter of an hour I sat observing it. He had had a very restless night, but the temperature was 98.4° F. He indicated he wanted to pass urine, by rubbing his pubes, and trying to slip out of bed; he passed large quantities rather frequently; the skin not acting well, compared with other patients at this time of year. Of course "punkahs" and "tatties" were working freely; the temperature of the room was kept down to about 90° to 94° F. About 10:30 a.m. the pulse became worse, violent twitchings of the left side of the face and left arm set in, which lasted perhaps five minutes, and recurred about every second hour; loss of power in the *left* arm was noticed, and loss of sensation in the left leg. The pulse, however, very soon improved, but was slow. I gave him 10 minims of liq. strychninæ. He was rapidly developing a scarlet-fever-like rash all over his body, but mostly about the back and buttocks and backs of the arms; I now noticed that the swelling over the right temple was very marked, and some discolouration was apparent low down behind the right ear. The head was shaved to allow of the closer application of the ice bags.

At 4 p.m. the temperature was 101.6° F., the twitching of the face and arm were frequent, and these symptoms increasing, with grinding of the teeth, at 8 p.m., together with some dilatation of the right pupil commencing, I thought I would probably trephine in the morning, and requested the night sister to prepare the instruments, &c. When the fit was over the pupil contracted again, and the left pupil now became slightly dilated also, whilst a fit of twitching was going on. During the night I gave 2 minims of croton oil and 20 grains of bromide three times.

At 11 p.m. he was comatose, the left arm colder than the right; pupils slightly dilated, especially that on the right side, but acting to

light; the croton oil had not acted and I gave him an enema, with a good result.

On May 25th, however, at 7 a.m., there was a marked improvement; the coma had passed off, he readily protruded his tongue when asked, the pulse was 54 and regular, and he asked what had happened, said he had a pain in the abdomen (croton oil), and asked for some port wine and brandy mixed for it. The bowels were now again moved; the temperature was 97.4°F.; he grasped my hand tightly with the right hand when asked, but could not do so with the left, and there was loss of sensation all over the left half of the body. The operation was postponed for the present; later in the day he recognised me, and about 10 p.m. called me by name; the twitchings of the face continued about every hour, and those of the arm about every sixth hour.

On May 26th, about 7 a.m., he had a severe attack of twitching of the face and arm, with grinding of the teeth, and he became comatose, with exaggerated knee-jerk, no ankle clonus or plantar reflex on the left side, and the right pupil dilated; so at 10.30 a.m. I trephined over the right middle meningeal artery, which I found bleeding; I tied it and cleared away the clot for an area of a five-shilling piece in an upward and forward direction; the dura mater appearing normal in colour; I did not open it. A fracture was seen to run from a point low down between the ear and the eye right over the vertex. By an incision of the scalp upward in the line of the fracture, I formed the opinion that it extended to the opposite side and that there was no depression, but I removed a loose piece of bone about the size of half an almond near the vertex, beyond which I did not continue the incision. The pulsations of the brain became apparent and the wound was stitched up; the trephined button of bone was not replaced, and a small india rubber drainage tube was laid from the dura mater to the angle of the wound, just over the ear. Iodoform and dry boracic wool were applied and the wound healed by first intention; the tube being shortened, was removed two or three days later.

An hour after the operation the patient was dozing naturally, with no stertor, a pulse of 64, which was regular, and an occasional slight twitching of the face only. At 9.30 p.m. patient recognised things, and conversed easily, but now and then he made violent efforts to get out of bed; he was given two large doses of bromide and chloral, with the result that he went to sleep at midnight and slept till 3 a.m.

On May 27th he was again very restless and violent, and at 3.30 a.m. I gave him another 30 grains of bromide and 20 grains of chloral; he slept till 8.30 a.m., awaking with a good regular pulse of 72, respiration 20, and the temperature, which had been 100° F. last night, normal.

The tongue was also cleaner; the wound was dressed; later in the day (May 27th) 20 grains sulphonal was twice given. During the day, however, I noticed the pulse and respirations were increasing until about dusk, when they had reached 84 and 24 respectively, but as the bowels

had not been moved for nearly two days, he was given an enema, which moved him twice, and then 4 grains of calomel. He slept a great deal, with slight twitching of the left side of the face, but none of the left arm, pupils small and nearly equal; the pulse and respirations fell during the early part of the night on May 28th, were 70 and 20 respectively, with a normal temperature, and some general improvement in his condition.

On the morning of May 29th the pulse and respiration were 64 and 20 respectively, the temperature 99° F., and the loss of power in the left arm and sensation of the left side had practically quite recovered. The tongue was easily protruded and was clean, but he was still drowsy from the hypnotics. Last night, as I formed the opinion that it was expedient to hasten absorption of the inflammatory products, 5 grains of iodide of potash every fourth hour was commenced for six doses, then every eighth hour. I had recently treated a case of paralysis of the left arm, nearly a month old, after concussion of the brain, in the same way, with the result that in three days the arm had regained almost all its lost power, and in another week was as strong as ever.

An enema was given with a poor result, so a saline of 2 drachms each of magnesium and sodium sulphate, with 20 grains of bromide and bicarbonate of potash, was given with syrupus aurantie; calomel seemed to have no effect on him, for he had had three doses, with no result.

On May 30th the pulse was 64, the respiration 20, and the temperature 98.4° F., he was rapidly becoming intelligently conscious, somewhat restless, and had had no twitchings of the face since 6 a.m.

On May 31st there was marked general improvement; he opened his eyes, looked about him, and asked questions. He is of a very active disposition in health; very much given to having his own way and being quite irrepressible in his Mess. He is 21 years of age with a rather small, compact, well-formed frame, and a deep broad chest. The pulse was now 70, respirations 20, and temperature 97.4° F. this morning, and he is beginning to resent being kept quiet in bed. I was proceeding to-day to Muttra for two months' duty, but this has been now postponed for four days for me to watch the case.

On June 1st the improvement continued. On that date there was only some paralysis of the left side of the face, and he can converse intelligently, but he is getting terribly restless and disobedient; it takes two or three male nurses to keep him in bed. The bruises and abrasions about the head, body and limbs, are disappearing. The iodide is omitted to-day and 20 grains of potassium bromide given thrice daily, with raw eggs and milk, mutton essence, fruit, barley water and lemon. The ice bags are continued.

On June 2nd the patient's condition still continued favourable; pulse 74, regular, respiration 20, and the temperature normal or subnormal. He insists that he is quite well and is causing a great deal of trouble.

On June 3rd, after a very restless night in spite of bromide and

chloral, he became quite maniacal, tore up his pyjamas, and it took three men continually alert to keep him in bed. I reasoned with him in his lucid intervals, and compounded with him to let him sit in an arm chair, as the pulse was good; all this struggling was much worse than quietly slipping out into the chair. However, in five minutes he wanted a bath (he has been sponged all over daily), so I put him in a hot bath, which had a considerable soothing effect on him, and he slept, more or less, for two hours after it; then he wanted to sit up, then to be shaved, and all was allowed; finally he wanted to dine outside, have solid food, and a bottle of champagne, for he said he "felt as weak as a cat." However, I gave him a smart saline, containing a large dose of bromide and chloral, and arrangements were made for me to again postpone proceeding to Muttra for a week.

On June 4th the patient was freely purged, and another dose of bromide and chloral sent him to sleep for the afternoon and night. Five grains of pot. iodide every eighth hour was recommenced.

On June 5th he was much more tractable; there were two hallucinations during the day: one was that he was under arrest, and the male nurses were witnesses against him; and the other, that a picture on the wall was photographing him. He was satisfied to be allowed to sit in the armchair and read a paper, but the room was so dark, it was obvious that he did not read anything; after ten minutes he thought he would go back to bed, which he did, and slept for two hours, and was quite rational when he awoke, and recognised the Captain of his Company, who I allowed him to see, at his request, exactly fourteen days after his accident. He, however, was rather restless through the night, and had a dose of bromide and chloral at 10 p.m. and 4 a.m.

This morning, June 6th, he was sleeping a good deal, but awoke rather suddenly about 10 a.m., and insisted on getting rid of his pyjama trousers, but I calmed him by allowing him to sit up in an armchair under the "punkah" and gave him 20 minims of tincture of opium. He also had a hot bath daily and was shaved, all of which pleased him and kept him quiet. He was much stronger on his legs than he was two days ago; of course he was carefully watched that he did not harm himself, he having asked for scissors or a knife to cut his pyjama ropes, and then for a match to burn them through. He was given chicken and bread and butter last night. Possibly the chloral is causing the hallucinations, as he has had a good deal, so at 10.30 a.m. I gave him 20 minims of tincture of opium, as he was rather noisy. He recognised the Padre, who looked in and spoke a few words to him.

On June 7th I find I have the following note: This patient slept at intervals yesterday and last night. When awake he sometimes had lucid intervals, in which he was quite sensible, and sometimes he would ramble on a lot of nonsense about theatricals, the Queen of Spain, that he had heard she was a good actress, and sometimes he would be fractious with

his nurses, the chief thing being that he wanted to lie on the bed without his pyjamas on. There have been no special signs of cerebral irritation. The evening before I find he wrote a note to one of the officers in his regiment, in which he gave the initials of the officer in the address quite correctly, but the letter itself was to the effect that the father of the King of Portugal was dining with him, that therefore he could not come to the Mess. He added that His Royal Highness might also come, but, at any rate, he had only one guest. Liqr. opii. sedatious, ℥ xxx., was given at 10 p.m. last night, and ℥ xx. at 4 a.m. this morning, and he has now just awakened after a seven hours' sleep, and insists on lying on his bed without his pyjama trousers on. He was immediately calmed by being allowed to have them off and thrown over his thighs, when he lay quite still. He seems to have quite recovered from the immediate effects of the accident and operation, as his general health and digestive organs are satisfactory; he is quite strong again in the arms and legs, the bruising and swelling have practically disappeared and the wound healed. There is some tendency to constipation, which has to be corrected.

The accident occurred eighteen days ago. This morning I took his Colonel in to see him for a few minutes, and this evening the General Officer Commanding the Division. He recognised them both, asked intelligent questions, and spoke of events which had occurred two or three months previously. As it is somewhat urgent for me to get to Muttra, I have to-day handed over the case for two months, reported as under to the General Officer Commanding for the daily report to the headquarters, and for the weekly report by mail to his parents.

Lieutenant S.'s general condition, now eighteen days after the accident, in so far as the injury and operation is concerned, is most satisfactory; in fact, he may be said to have recovered from the immediate effects of the injury, and the operation wound is practically healed. The mental power, however, I regret to say, gives evidence of becoming unbalanced. There are lucid intervals, in which he is quite sensible and will converse intelligently; but yesterday and to-day these have not been of such long duration as formerly, and he is liable to ramble off into matter, the nature of which I cannot understand or piece together. This may go on for weeks only, or months, and may be recovered from, or may only partially be recovered from, or may become chronic, or may cause death.

My thanks are due to Lieutenant-Colonel A. S. Rose, R.A.M.C., Lieutenant-Colonel Smith, I.M.S., Captain F. A. H. Clarke, R.A.M.C., and Lieutenant Brodribb, I.M.S., for their kind advice and assistance at the operation.

NOTE.—On June 20th I received a letter which remarks that the patient is very much better.

REPORT ON TWELVE CASES OF REMOVAL OF INTERNAL SEMILUNAR CARTILAGE FOR RECURRENT DISLOCATION.

BY MAJOR F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

DISLOCATION of a semilunar cartilage is a fairly common accident in military life. Jumping off the "shelf" and vaulting the horse in the gymnasium are responsible for a certain number, but I think that football will be found to account for the majority of cases. Eight out of this series were operated on during the winter months.

A good many men are admitted to hospital with the diagnosis of synovitis of the knee-joint, but if the history of their accidents were gone into dislocation of a semilunar cartilage would be found to be the correct diagnosis. Some of these men will be found to have repeated entries of synovitis of the knee on their medical history sheets. This should lead to a suspicion of the proper cause for their complaint. I have invariably found that the patient gives a history of wrenching the joint; but the injury is very often trivial; that he felt something slip out on the inner side of the knee and that the site of the cartilage is distinctly tender on pressure; also, that the knee became flexed and remained so until he pushed the "something" back; or, more frequently, the leg is forcibly straightened for him. He then becomes able to walk. In some cases an anæsthetic is required in order to reduce the cartilage. Synovitis invariably results, but to a varying degree. Once a cartilage has become displaced it practically never becomes fixed again, and frequent recurrence of the dislocation is the rule.

On account of the nature of the soldier's occupation, and of the impossibility of providing him with any apparatus for keeping the cartilage in its place, I hold that every soldier who suffers from a recurrent dislocation of a semilunar cartilage should either have it removed or be invalided. The injury is likely to recur just at the time when he is wanted to undertake some important duty, and it will render him inefficient for at least fourteen days. Such a man can never be depended upon. Stitching the cartilage in its place is of no use in preventing a recurrence of the dislocation.

It must be fully borne in mind that in operating on the knee-joint one must be absolutely certain of one's ability to ensure the strictest asepsis. Probably the best guarantee would be that one has done a considerable number of major operations without once having anything in the shape of suppuration. In this way the operator would be in a position to know that he could trust himself and his methods, and can promise that the operation shall not be attended with undue risk. In dealing with the peritoneum one can rely on this membrane to dispose of a good many micro-organisms; but in operating on the knee-joint, if by any chance germs are unfortunately introduced, the synovial membrane has very little

power of dealing with them, and so trouble will certainly result. The previous history of the patient, especially with regard to alcoholic habits, should be carefully gone into. The only case in this series which gave me any anxiety was my first one. I found out, subsequent to the operation, that he was a chronic alcoholic mess-waiter. No joint should be operated on until the whole of the effusion has disappeared, and the skin should be absolutely healthy. If blisters or Scott's dressing have been applied, time should be allowed to elapse so that the skin becomes perfectly sound.

The operation which I have practised in the majority of these cases is as follows: The skin over the whole of the joint area is shaved and thoroughly washed for about two days before the operation. In the theatre it is again cleaned with turpentine spirit, soap and methylated spirit. The area of operation having been carefully surrounded by sterilised towels, the knee is slightly flexed, and the hip joint rotated outwards. A curved incision is made from the inner side of the ligamentum patellæ and carried over the upper part of the inner head of the tibia to a point just short of the internal lateral ligament. The capsule is then divided, and in many cases the thickened synovial membrane bulges into the wound. This is incised in the full extent of the wound, and all bleeding points are ligatured with fine silk. The cartilage is seized in a pair of forceps, forcibly pulled forward, and divided as far back as possible by a knife passed into the joint. It is most important to arrest all hæmorrhage by ligature, otherwise distension of the joint may ensue and require a subsequent operation for the removal of the blood. In seven of my cases a considerable thickening of the synovial membrane over the cartilage and extending some distance upwards was found. It was very probable that the symptoms of dislocation of the cartilage were produced by this pad slipping between the bones. This thickened synovial membrane should be freely removed with the cartilage attached. The synovial membrane and capsule are then united by a continuous suture of thin kangaroo tendon, and the skin by a continuous suture of the finest silk-worm gut. New marine sponges were used in all the cases. I do not now use drainage. A back splint with foot-piece is applied and the limb elevated by pillows.

In my first two cases I inserted a drainage tube through the wound and kept it there for twenty-four hours. It became blocked, and the joint did not drain. In the first case (the alcoholic subject) it appeared to cause irritation of the edges of the wound and to inflame the joint. It became necessary to drain the joint by free incisions, but he was discharged from hospital at the end of two months, walking well.

In the next two cases ice-bags were applied to the joint immediately after the operation, and no drainage tubes were used. They had no effect on the amount of the synovial effusion which results in every case from the operation.

No.	Number of relapses	Name	Date of operation	Date of discharge	Right or left cartilage	Remarks
1	4	Private M. . .	1. 4.05	3. 6.05	R.	Alcoholic mess-waiter. Last dislocation was produced by pulling on his socks. Marked thickening of synovial membrane. Joint drained through incision.
2	4	Driver E. . .	7. 4.05	10. 5.05	L.	Drainage through incision for twenty-four hours.
3	2	Gunner K. . .	26.10.05	21.11.05	L.	Ice-bags round joint for three days after operation.
4	7	Private G. . .	26.10.05	14.12.05	L.	Ice-bags round joint for three days. Operation on November 15th for varix.
5	2	" M. . .	13.12.05	3. 1.06	L.	Marked thickening of synovial membrane over cartilage; drained for twenty-four hours from upper part of synovial pouch on outer side.
6	3	" L. . .	1. 2.06	9. 3.06	L.	No drainage. Synovial membrane over cartilage very thick.
7	Several in 2 years	Col.-Sergeant McK.	16. 2.06	5. 3.06	R.	No drainage. Done under eucain and adrenalin.
8	Several in 6 years	Sergeant S. . .	27. 2.06	14. 3.06	L.	No drainage. Enormous thickening of synovial membrane and of cartilage.
9	12	Private H. . .	21. 2.06	23. 3.06	L.	No drainage. Had to be reduced under gas on admission. Synovial membrane very thick over cartilage.
10	12 during past 6 months	Private D. . .	8. 3.06	6. 4.06	L.	No drainage. Had to be reduced under gas on admission. Cartilage very thick; synovial membrane leading down to it from upper part of point was enormously thickened. It was extensively removed.
11	6	Gunner T. . .	12. 3.06	6. 4.06	L.	No drainage. Synovial membrane very thick over cartilage, and extending for some distance over internal condyle.
12	Many times	Lance-Corporal E. . .	16. 5.06	5. 6.06	R.	No drainage.

In the fifth case I closed the wound and passed a drainage tube into the upper and outer part of the joint through a fresh incision there. This was the lowest point when the limb was elevated on pillows. No benefit resulted.

In the remaining seven cases no drainage has been used. These cases have required less morphia after the operation than the first five, and the recovery has been more rapid. A hypodermic injection of morphia, a quarter of a grain, is usually needed on the first night, and sometimes on the second, but many of the later cases have required none.

The sutures are removed and the splint taken off about the eighth day and passive movement begun. The patient sits up on the tenth day, and usually walks a little on the twelfth day. He is discharged to sick furlough in the middle of the fourth week.

One case was done under eucaïn and adrenalin. He went to duty in seventeen days, walking perfectly. He felt considerable pain when the cartilage was pulled forwards, and I do not recommend this method of anæsthesia for such cases.

[Since this paper was written, I have operated on seven cases of dislocation of internal semilunar cartilage, and one case of internal derangement, due to enlarged synovial fringes. Eucaïn and adrenalin was the only anæsthetic used. Having mastered the proper technique, I am now quite satisfied that a general anæsthetic is unnecessary for these operations. I hope to be able to report a further series in a later paper.—F. J. W. P.]

Travel.

THE INTERNATIONAL CONGRESS AT LISBON, 1906.

By COLONEL A. T. SLOGGETT, C.M.G.,
Royal Army Medical Corps.

As possibly a short account of my visit to Lisbon as representative of the Army at the Fifteenth International Medical Congress may be of interest to your readers, I send you a few notes on my trip.

On receiving official notification that I had been selected to represent the Army, I went to the War Office for further instructions, and was advised to proceed by the s.s. "Ophir," which had been specially chartered by the Committee of the British Section for the trip to Lisbon. A few days after my appointment I was requested by that Committee to join their number, which I, of course, did, and attended several meetings.

The s.s. "Ophir" started from Tilbury on Thursday, April 12th. Every berth on board had been booked, and two special trains conveyed the passengers from St. Pancras to Tilbury, which place we left about 2 p.m. The ship was crowded with medical men and their wives and families from all parts of the United Kingdom; in addition to these there were a large number of ordinary tourists. The original idea was that the ship should call at Cherbourg for any French passengers who might be going to the Congress, but as none had booked passages this was not done, and we proceeded under very easy steam down channel to Vigo, which was reached on Sunday, April 15th. Here we remained all day, the passengers availing themselves of the opportunity of visiting the town. On Tuesday, 17th, the "Ophir" anchored in Tangier Bay, where she remained until mid-day. Tangiers is a picturesque and indescribably filthy place, but is well worth seeing, and was naturally intensely interesting to most of the passengers, who had never seen the East before—it reminded me of a mixture of the slums of Cairo and Jerusalem. From Tangiers the ship proceeded to Gibraltar, where we remained until the evening, when we sailed direct for Lisbon, which we reached on the 18th, and anchored in the Tagus about a mile and a half from the shore. This in itself was one of the many great drawbacks to being on board the "Ophir," as the distance to the Congress Hall made getting backwards and forwards most inconvenient, especially at night.

Lisbon itself from the Tagus is the most picturesque city I have ever seen. The river is magnificent, about six miles across, and as the houses are all roofed with enormous red bricks and fronted with terra-cotta tiles of various colours—some houses being yellow, others blue, &c.—the general effect, which although when close is a little *bizarre*, when seen from the Tagus is really lovely. Then, too, the conformation of the city lends itself to this, as it is built on seven hills.

Very early on the morning of the 19th, together with a crowd of other British members, I proceeded to Congress Hall, for which the new Medical School had been utilised. It is an extremely fine building, and well adapted for the purpose. I shall never forget my arriving at the Hall, and the scene of indescribable confusion that existed—about a thousand members, with a large sprinkling of ladies, gesticulating and screaming in every known language, and all trying at the same time to get their receipt for their subscription from a small office, behind the counter of which stood one solitary woman, who proudly informed me later on that she was

English, though she had been brought up in Portugal. She apparently conversed with ease in about seven different languages, and showed the most amazing coolness, fortitude and courtesy, under most trying circumstances. The only time I noticed her flinch was when a hirsute Russian, filled with "vodka," insisted on placing his head on the small counter and declined to move, and as he apparently could speak no word of anything but Russian, and as no one there could speak that language, it was with difficulty he could be got to withdraw. The first thing one had to do was to pay a fee of £1 at this office, on which you were given a receipt and directed to another office, where you would receive a "card of identity," with your name and description on it; without this you could not enter the Congress. After a long and desperate struggle in a crowd of all nations, to which a football scrimmage is child's play, I at length, after a two hours' fight, emerged black and blue, and somewhat ruffled in temper, but triumphant, with my "card of identity." Having procured this, I then had to go to the English bureau and get my "badge." In my case, being a Government delegate, this consisted of a silver medal with gold braid (delegates from universities had silver braid, and ordinary members a blue and white ribbon); I was also here given a programme of the proceedings, and a large packet of papers — chiefly advertisements of patent medicines. By this time it was nearly 12 o'clock, so, as the King and Queen were to open the Congress in State at 2, at the Museum of the Geographical Society, I had to hurry back to the "Ophir" to change into full dress to attend the ceremony. This I, by great good luck, just managed to do in time.

The Hall in which the opening meeting took place was not a large one, and was roofed with glass, and as nearly four thousand people were packed inside, the heat was indescribable. The Government delegates were seated on the platform, but as not nearly enough chairs were provided—certainly two out of three had to stand—and only those who arrived an hour beforehand got seats. Deputy-Inspector-General Johnson representing the Royal Navy, Surgeon-General Branfoot the Indian Government, Sir Dyce Duckworth the Privy Council, and myself, as the four Government delegates from Great Britain, were on this platform, and there being no seats left, we took up a position immediately behind the chairs of the King and Queen (not the first time, as I observed to a foreign officer, that the English Navy and Army had supported the Throne of Portugal).

The scene was a brilliant one, and an excellent speech was made by the King, of course in French; after this the President gave a long address with especial reference to the interest taken by the Queen in medicine; when he had finished the Government delegates from each country in turn, including the smallest States like Chili, Cuba, &c., made a speech. Some of these were interminably long and dull, a notable exception being Sir Dyce Duckworth, who spoke for the English Government and made an excellent speech, short and to the point. The proceedings terminated with a long oration from the Prime Minister, and at last the meeting was over and we thankfully dispersed. That same evening an "At Home" was given by the Portuguese Committee at the Medical School; an immense crowd went, but it was too far for the party from the "Ophir" to attend. On Friday, 20th, early in the morning, *i.e.*, at 8 a.m., the *serious* business of the Congress commenced, or, rather, was supposed to commence. I can only speak of my own section, *i.e.*, "Military Medicine Section, No. XV." (though I attended meetings at several of the others); this was held in a small room, in which were placed rows of chairs like a class-room. At the top was a table where the President for the time being (nearly everybody took their turn) sat whilst some one got up and read a paper—the whole thing was a farce. Someone would get up and read a paper very fast, either in German, French, or English; perhaps only one or two in the room were able to understand him, the others either left, or carried on an animated conversation between themselves, so that practically, it amounted to a solemn president, a bored-looking secretary, neither of whom understood a word, and the man reading the paper to an audience of perhaps two or three; as most of the papers were afterwards printed it would really have saved both time and trouble if they had all been taken as read. Twenty Sections were proceeding at the same time, and every day there were numerous social functions and expeditions in which the congressists took far more interest than in the sectional work. Then, too, there was an entire lack of organisation and discipline. No programme of the proceedings for the day was issued, so it was quite impossible to know when any papers would be read. You would go to your Section at, say, 10 a.m., and find it shut, with two or three members waiting about; in half an hour perhaps, the door would open, and a heated conversation would take place between the secretary of the Section and some furious Southerner who had been impatiently waiting to astonish the world with his paper. Finally, a president

being secured, the poor gentleman would get up and ease the travail of his soul to empty benches.

On the 20th a garden party was given by Sir Francis Cook, at Montserrat, to which nearly everyone went. The mansion of Montserrat is beautifully situated at Cintra, about sixteen miles from Lisbon. The scenery defies description, and the day was a most enjoyable one.

On April 21st, in the afternoon, together with some members of my Section, I visited the Castle of St. George, the Artillery Museum, and the Military Hospital, and in the evening a dinner party was given by the King and Queen to the Government representatives. Four from each country were invited, though for Great Britain there were six, viz., Deputy Inspector-General Johnson for the Royal Navy, myself for the Army, Surgeon-General Branfoot for the Indian Medical Service and Sir Dyce Duckworth, Sir Thomas Barlow, Bart., and Surgeon-General Sir Benjamin Franklin; altogether about one hundred and twenty guests sat down. After the dinner was over all the guests were presented to Their Majesties by their respective Ministers, our Contingent being the first to be presented by Sir Francis Villiers, our Minister, who, I may say, showed me the greatest kindness and hospitality throughout my stay at Lisbon.

The King and Queen were most kind, and the Queen is a delightful and charming woman, speaking English perfectly; my brother officers will be perhaps interested to know that Her Majesty was greatly interested in our Corps organisation, and was pleased to admire the Royal Army Medical Corps' uniform very much.

On the 23rd the Military Section were invited to a trip on the Tagus by steamer; luncheon was served on board; in the afternoon we visited the Sanatorium of Parede and Monte Estoril.

On the 24th a garden party was given by the King and Queen in the grounds of the Palace of Necessidades. There must have been over four thousand people there, and as every officer was in uniform and the ladies in their smartest gowns, the scene was really beautiful.

On the evening of the 24th the "Ophir" left Lisbon for Leixoes, the Port of Oporto, which is situated three miles up the river Douro. Oporto is built on a semicircle of hills, the houses rising in terraces; it is a most delightful old-world and picturesque place, and is, of course, the centre of the port-wine trade. Here the delegates and their wives were entertained by the British residents,

who gave them a river picnic; it was extremely well done and everyone enjoyed it immensely. In the evening twenty of us were entertained at a banquet given in the "Factory," or Clubhouse, used by the port-wine shippers, a most historical and delightful old place. The visitor's books here were of the greatest interest, as Wellington made Oporto his headquarters during part of the Peninsular Campaign, and one saw in them the names of hundreds of English officers who were present there then, and who had been made honorary members of the "Factory" during their stay at Oporto. A quaint old custom existed at dinner: we first dined in one room, and, on reaching the dessert stage, everyone got up and went into another room in which the table was laid in precisely similar fashion to the one we had left; the table decorations were the same and we sat in the same places—in fact, it was difficult to realise we had moved to another room. Here the solemn rite of port-drinking took place, and the idea was, that one's palate should not be vitiated by remaining in a room where one had been eating, and where the smell of food might remain. We returned to Leixoes by special tram-cars, after a most excellent dinner and enjoyable evening.

That night we left for England, Tilbury being reached on April 30th; and so ended a very pleasant trip, which although of not much benefit professionally, still was of intense interest on account of the number of foreign medical officers of other armies which one met. I was immensely struck with the recognition they showed of our advance over them in having our own Corps, and our using ordinary military titles, and how they ungrudgingly owned that we were in advance of them in many respects.

The foreign officers who showed the most *bon camaraderie* to the English Army were the Germans, two of whom were most cheery fellows, and, of course, the Americans, who were just like ourselves.

I noticed that our Corps badge was worn by several of the continental armies. Uniform (full dress) was, of course, invariably worn on all official occasions, a somewhat trying thing, as a cocked hat and tight-fitting tunic does not conduce to comfort in a hot country, but as all the Foreign Officers invariably wore uniform, I had to do the same.

Before ending, I must pay tribute to the extreme kindness and courtesy shown to me by everyone with whom I was brought in contact at Lisbon, and my admiration for the way Professor Bombarda, the Secretary-General, fulfilled his arduous duties. I

was extremely fortunate, too, in having such a delightful companion as Deputy Inspector-General Johnson of the Royal Navy, a most able officer and a most cheery soul.

Translation.

ADDRESS DELIVERED BEFORE THE JAPANESE MEDICAL ASSOCIATION AT TOKIO, ON THE 7th APRIL, 1906, ON THE SUBJECT OF THE MEDICAL SERVICES IN THE RUSSO-JAPANESE WAR.¹

BY SURGEON-LIEUTENANT-GENERAL M. KOIKE, M.D.

Director-General of the Japanese Army Medical Service.

(1) *The number of Killed, Wounded, and Sick.*—Twenty-one months passed between the declaration of war and the restoration of peace. Some twenty battles, big and small, were fought during these months, causing 220,812 casualties. The details are as follows :—

Killed.—47,387, including 19 medical officers.

Wounded.—173,425, including 104 medical officers ; 450 rank and file of the Bearer Corps were killed and wounded.

The total number of sick admitted to hospitals amounted to 236,223 ; and of that number 27,158 were infectious cases. In addition to the foregoing there were also 97,850 sick admitted to hospital from mobilised units at home and in Formosa. The grand total of killed, wounded and sick, therefore, amounted to 554,885. If the 77,803 sick and wounded Russian prisoners treated in our hospitals (which number includes 559 disabled Russians who were sent from Port Arthur direct to their own country) are added, the total really reaches the extraordinary number of 632,688.

(2) *Medical Personnel : Officers.*—In the treatment of the above enormous numbers, the following medical *personnel* was employed :—4,517 Army medical officers, including the Principal Medical Officer of the Field Forces ; of this number, 2,829 were called out after the outbreak of war. 639 Army pharmacists (officers), including the Principal Pharmacist of the Forces ; 487 of these were called out during the war. The total number of medical officers employed, therefore, amounted to 5,156.

Men.—7,322 chief nurses ; 4,144 assistant nurses ; 21,797 attendants. 334 men were employed in the care of medical and surgical instruments.

¹ Published by permission of the Director of Military Operations.

The total number of men employed, therefore, amounted to 33,597. Thus the grand total of officers and men engaged in the treatment of sick and wounded amounted to 38,753.

The Japan Red Cross Society did its best to assist the Army Medical Service. The total of the *personnel* of the Red Cross Relief Sections was 5,479. Of these, 373 were doctors, including the Director, and 175 were pharmacists; the rest were perfectly trained male and female nurses. The relief sections were distributed among hospitals on the line of communications and in Japan, and among hospital ships; they took charge of the transport, treatment and nursing of the sick and wounded in an eminently efficient manner.

Here I must not omit to mention the assistance rendered by the Ladies' Benevolent Society of the Japan Red Cross, and also that given by friends at home and abroad. Among these were princesses, marchionesses, and many other ladies of noble and gentle families. Their hospital nursing and visits produced wonderfully good results on the poor soldiers who had fought for their country.

239 civil doctors, who were doctors of medicine of different academies and colleges, and even doctors from the Imperial Household Department, came to assist. Therefore, besides the 38,753 Army medical officers and men, the following assistance was received from different quarters:—5,709 from the Red Cross Society, including three foreigners.

Consequently, altogether 44,465 doctors and men were engaged in medical services; and of this total I find that 5,131 were military and civil doctors. Statistics, therefore, show that each qualified doctor treated, on an average, 113 sick and wounded men.

(3) *Medical and Surgical Material*.—Never once during the whole war did we experience a shortage of material. On the contrary, we had always a plentiful reserve on hand throughout the armies. Most—in fact all—of these materials were issued from the Army Medical and Surgical Supply Depot. Nearly 300,000 packages of these materials were used, costing a little over 7,100,000 yen (about £710,000). The “Seiro-gan” pills (“invasion of Russia” pills), *i.e.*, the creosote pills for preventing internal diseases, were manufactured in Tokio, and dressings and bandages were made by the members of the Ladies' Benevolent Society and others. 42,400 triangular bandages were graciously given by H.I.M. the Empress, Crown Princesses, Imperial Princesses, and Princess Arisugawa. When these latter bandages were distributed among the sick and wounded in the hospitals at home and at the front, they were used but once and carefully kept by the recipients, with the object of sending a welcome present to their homes.

(4) *Transport of Sick and Wounded to the Rear*.—This was the hardest task of the medical service. Fortunately, we were able to use the railway line, which the enemy had left untouched. The way we transported the sick and wounded to the rear was as follows:—

Transport to the etappen hospitals, which were always situated near the railway line, was carried out by stretchers, Chinese carts, and even by our general service transport carts. From these hospitals to the hospitals at the ports, transport was carried out by railway trains. Light railways were used by the 1st and Yalu armies in transporting sick and wounded to Antung. The rivers Liao-ho, Hun-ho, Ai-ho, Ta-yang-ho, Yalu, Ta-tung-chiang and Hang-chiang were all used for transportation, while the Tonnaicha Lake was used in Saghalien. Sick and wounded were transported from the following ports to Japan :—Ying-kow, Tai-ren (Dalny), Lien-shuten, Yen-ta-ao, Ta-ku-shan, Yong-am-pho, I-hoa-pho, Chin-nam-po, Ki-chin-pho, Chemulpho, Fusan, Yong-san, Syo-ho-chin, Chhyong-chin, and Syong-jin. In Saghalien, Korshoff and Alexandoroff, Eighteen Army hospital ships were used. Besides these there were six transports improvised for carrying sick and wounded. A few more regular transports were also used for the service of transportation. At times, when 9,000 sick and wounded were collected at Dalny, naval assistance was also asked to convey the men home. Serious cases of illness, wounded, and cases of infectious and mental diseases were conveyed by the hospital ships ; while the other ships were engaged in the conveyance of slight cases. The ports of disembarkation were selected as follows :—Moji for Kiushu Island, Tadotsu for Shikoku, Ujina and Osaka for other places.

Rest stations for sick and wounded were established in each of the above ports, and all sick and wounded were received into base hospitals through these institutions. Aomori was selected for the sick and wounded from Saghalien. Up to the end of December, 1905, a little over 163,000 had been conveyed by the hospital ships, and rather over 157,000 by other ships.

(5) *Results of Treatment.*—The percentage of recovery of all sick and wounded admitted to the hospitals from all units at the seat of war, at home and in Formosa, was 63·23 per cent., while that of deaths was 7·49 per cent. The percentage of recovery of all sick and wounded of the units at the seat of war was 71·58 per cent., and of deaths, 6·83 per cent. Comparing these percentages with those in time of peace, at the end of 1903, the following statistics are shown :—

	Peace time				War time				
Recoveries	..	75·05	per cent.	..	63·23	per cent.	..	..	} Units at home and at the seat of war.
Deaths	..	1·18	„	..	7·49	„	..	..
Recoveries	71·58	„	..	..	} Units at seat of war only.
Deaths	6·83	„	..	..

The above shows that in war time the percentage of deaths is far higher than in time of peace. Let us compare this with the percentages taken in the China-Japan war.

Address Delivered before the Japanese Medical Association 627

			China-Japan War		Russo-Japanese War
Of all the units at home	(Recovery ..	..	50.94 per cent.	..	63.23 per cent.
and at the seat of war	(Death ..	..	14.24	..	7.49
Units at the seat of war	(Recovery ..	..	54.81	..	71.58
only	(Death ..	..	7.65	..	6.83

The reason why the latter death-rates are not very different as compared with the war with China is very simple. The Chinese ran away from us at sight, while the Russians made so stubborn a resistance that a battle sometimes lasted a fortnight, and obliged us, as we were under the enemy's fire, to transport the wounded under cover of night; moreover, being short-handed, we conveyed our poor wounded comrades under conditions, the urgency of which interfered with their proper treatment.

(6) *Sanitation*.—The greatest precautions were taken to prevent the following diseases: Infectious diseases, such as plague, small-pox, yellow fever, typhus, typhoid fever, cholera and dysentery; also frost-bite, swollen foot, and sunstroke.

(7) *Individual Sanitation*.—A pamphlet called "Precautions on Individual Sanitation" was published in February, 1904, and thoroughly distributed among the men. Medical officers gave lectures on the subject of individual sanitation once or twice a month at the front. In this pamphlet there were articles which were quite useless in Manchuria and in Korea, and consequently another pamphlet of similar title was published and distributed. In May, 1905, another pamphlet called "Precautions against Cholera and Plague," was published and distributed among the men. The use of the "Seiro-gan" (creosote) pills was made obligatory even among officers. These prevented, in a most satisfactory way, the spreading of such diseases as typhoid fever or dysentery, which usually attack the intestines. The manufacture of pills was started in March, 1904, at Tokio, and nearly four millions of them were made.

(8) *Sanitation in Camps and Quarters*.—In the front lines men lived in tents (*tentes abris*), holes dug in the ground, and in shelters constructed of any materials available. In the rear lines men lived in village houses which had not been cleaned from time immemorial. The first thing to be done, therefore, was to sweep the dirt from the ceilings and floors, paste old newspapers on all the walls, and sprinkle a solution of carbolic acid about. After finishing the inside of a house all refuse was removed and burned. Bath-rooms and latrines were constructed. Drains were dug to such an extent that the soldiers used to say among themselves, "Why, we seem to have come from Japan to clean the Manchurian villages." There were constant medical inspections of the villagers. Among other things, we suffered terribly from Manchurian flies. They were a regular plague, and a very disgusting one. Covers had to be made for food, drinks, cups and bowls, chop-sticks and toothbrushes, so that no flies could get at them. On the other hand, we did our best to destroy

them while still in the larval state. In a report submitted by a doctor of entomology attached to the 1st Kobi Division, he stated that flies lay their eggs in horse-dung and heaps of refuse, and that if these are removed and burned or buried, the flies may easily be destroyed before developing. Quick-lime, ashes of every description, and thoroughly dried earth were sprinkled upon night soil, so that flies could not have direct contact with it.

Clothing.—A thick overcoat was issued to each individual in the winter, besides his regular supply of clothing.

Food.—A good supply of food was provided, in addition to the usual rations. When men worked over eight hours they were given two *go* of rice (about 12 ozs.) and one-third of the biscuit ration extra. Only in the case of troops operating in the mountains did supplies, on one occasion, run short for a time. The issue of a mixture of rice and barley (four *go*, about 24 ozs., of rice to two *go*, about 12 ozs., of barley) was made compulsory, in order to prevent beri-beri. In summer, when food soon goes bad, 35 grammes (about 1oz. 75 grs.) of vinegar were mixed with every 200 *go* (about 75 lbs.) of rice. In winter, when food becomes quickly frozen, a piece of flannel was issued to soldiers to wrap their mess-tins up in. As far as the circumstances admitted, soldiers were ordered to cook their own rice in their own mess-tins; there were, therefore, very few complaints made by soldiers with regard to their food. Japanese *saké* was issued to the men as often as possible. They were strictly prohibited from buying drink of any kind from villagers, and were only allowed to do so from the military canteens, which the medical authorities examined at least twice a month.

Water.—Soldiers were instructed, in peace time, how to draw water from rivers, and also how to filter muddy water.

Wells.—Wells which produced good drinkable water were protected by sentries after an analysis of the water had been made by the medical authorities. Care was taken not to allow the villagers to draw water promiscuously from a well for fear one of them might be employed by the enemy to poison the water.

Unboiled Water.—The drinking of unboiled water is strictly prohibited in the army, whether in times of peace or of war.

Refreshment Stations.—Such stations were established at as many points as possible on the lines of communication, and even in the area of active operations. There were two or three soldiers told off as attendants at each of these stations, and they had boiling water ready night and day. Rough benches were erected under the trees in summer. Guide posts were put up at the sides of main roads showing the way to these stations. Notices were also put up at the entrances of a village showing the number of houses, the quartering capacity, the wholesomeness or otherwise of the wells, and the existence or non-existence of infectious disease among the inhabitants of the villages. In the fighting line men used their mess-tins

to boil water in, thus strictly obeying orders regarding water. Later, when we had captured the kitchen waggons of the enemy, we used them largely and found them of very great service. Mr. Ishiji's filter was also used with good effect. It was used mostly in the fighting line, where no smoke was allowed and fuel was difficult to obtain. This filter was first introduced into the army by Dr. Kitasato, the eminent bacteriologist, and it proved most efficient in destroying bacteria in water, and for converting bad water into purified drinking water, with neither smell nor taste. Mr. Hirayama's disinfecting waggon, and Mr. Yonezawa's pump were introduced to disinfect the rooms, ceilings and floors after a case of infectious disease. We sometimes even burned houses with a view to disinfection, and by working hard we were able to prevent the spread of typhoid and dysentery, though with difficulty.

The Disinfection of Transports.—A committee was appointed to each base port, and it visited every transport that arrived from the port. Men and baggage were taken to a quarantine station, and while the men were bathing, their clothing and baggage were disinfected by steam. We did everything we could in order to prevent the spread of disease, except inoculations for typhoid fever, dysentery, cholera and plague. The reason we did not inoculate for the above diseases is simply that we could not afford the time to apply the treatment to all soldiers who were constantly engaged with the enemy at short range; and, moreover, these inoculations are still in the experimental stage and their value is not yet proved.

(9) *Results Achieved by the Medical Service.*—The standard which decides the success or otherwise of the medical service of an army during a war is to be found by comparing the proportion of deaths from disease with the proportion of deaths from wounds, as shown by statistics. In European wars this ratio used to be as one death from wounds to six from disease, while the military medical services were still young, but in later wars this ratio decreased till it became as 1 to 1·18. Now, let us turn to the statistics of the Russo-Japanese war. Our ratio was as one death from wounds to 0·37 from disease, and this is only about one-third of that of European wars. Now compare this again with the statistics of the China-Japan war:—

		China-Japan War		Boxer Campaign		Russo-Japanese War
Wounded to sick	..	1 to 6·93	..	1 to 4·37	..	1 to 1·15
Deaths from wounds to deaths from disease	)	1 ,, 12·09	..	1 ,, 1·97	..	1 ,, 0·37

Let us now take another table:—

		Casualties in field battles		Casualties in sieges		Casualties in field and sieges combined
China-Japan War	..	1·35 per cent.	..	1·69 per cent.	..	1·37 per cent.
Boxer Campaign	..	2·66	..	..	..	2·66
Russo-Japanese War	..	13·65	..	17·79	..	14·58
European wars ¹	..	12·97	..	17·51	..	13·99

¹ European wars include wars from 1741 onward.

630 *Address Delivered before the Japanese Medical Association*

The following table shows the percentage of admissions and of deaths caused by disease :—

	China-Japan War	Boxer Campaign ¹	Russo-Japanese War
Percentage of sick ..	59·20 per cent. ..	34·88 per cent. ..	36·04 per cent.
Percentage of deaths from disease	9·29 „ ..	4·33 „ ..	2·99 „

Last of all, let us look at the monthly sick reports from each army in Manchuria and compare them with the monthly reports in time of peace, say in 1903. One army reported 6·42 per cent. of fresh cases of sickness, and this was the lowest received. Another reported 11·18 per cent., which was the highest. The average cases of sick reported during peace in 1903 was 10·31 per cent.

In conclusion, I have the honour to assert that the Army Medical Service during the Russo-Japanese war was as eminently successful as the war itself was, as a whole. I cannot help being proud that our medical officers and men carried out their duties just as well as the fighting men and officers of Army and Navy.

[The above address does not contain the full statistics of the war, but is of interest, in so far as it gives a general idea of the Japanese Medical Services from the point of view of the highest Japanese authority on the subject, and sketches broadly the main features of the medical *personnel*, the measures of sanitation in the field, and the general results.

With regard to the portion of the address dealing with the statistics of wounds and sickness, it should be noted that no figures of average strength for the period of twenty-one months are given; nor is it stated on what strength the percentages are calculated. It is, therefore, impossible to use either the gross figures or the percentages for purposes of comparison. However, it may be pointed out that Surgeon-General Koike, like most others who have dealt with the subject of the statistics of the war, and of the great diminution in the proportion of deaths from disease to deaths from wounds, has omitted to draw attention to the most obvious cause of the great alteration in this proportion, namely, the very large increase in the number of wounded and killed as compared with that of the more recent wars. Great increases in wounded influence this proportion, just as much as great decreases in diseases; and the closer one examines the figures the more one is forced to the conclusion that the former and not the latter condition has been the chief influence at

¹ The Boxer campaign is too small a war to compare with the Russo-Japanese war; therefore, the comparisons with the China-Japan war are the best to note. During the China-Japan war cases of frost-bite were 4·21 per cent.; but during the late war only 0·35 per cent. In the China war cases of beri-beri were 17·56 per cent. and during the late war 15·94 per cent. *Kakke* was the most dangerous enemy our Army encountered.

work in determining the marked alteration in the proportion of deaths from disease to deaths from wounds in the Russo-Japanese war as compared with the immediately preceding wars.

A recent announcement in a Japanese newspaper, the *Kokumin*, states that preparations have been made for writing the medical history of the war under different sections, one of which is statistical. The compilation of this work is estimated to take eight years, and until then one can only make approximate comparison of the medical results of the Russo-Japanese war.]

Current Literature.

A New Alpine Stretcher.—In the *Archives de Médecine et de Pharmacie Militaires* for September, 1906, Surgeon-Major P. Eybert, of the Army of Occupation in Tunis, contributes a lengthy paper on the "Transport of the Wounded in Mountain Warfare." After recapitulating the various means for normal transport, and also those for special emergencies, he gives a description (freely illustrated, and extending over 39 pages) of the proposed new Alpine stretcher.

Briefly described, this latter may be said to somewhat resemble the ordinary regulation stretcher, but with the following modifications: the patient's legs rest in two gutter-shaped splints alongside the stretcher-poles, the portion of the canvas between the legs being cut away; the patient is preferably carried head first, as this enables the bearer in rear to look through the gap between the patient's legs and thus see where to place his own feet when on difficult ground; the bearers are fitted with a special form of carrying straps which do not cut the neck or compress the chest, and the length of the braces is adjustable at will whilst the bearers are actually on the march. The loaded Alpine stretcher can also be carried *on the back* by a single bearer, for which purpose the lower cross-bar is made to be removable, and a headstrap gives the bearer the free use of both his hands. The stretcher can also be used as a *litter*; or fixed to a *cacolet*, which enables the patient to sit, recline, or lie down, at will; or fixed on to a *pack-saddle* (either side-ways, or saddle-fashion, and in each case with the patient's buttocks either resting on, or clear of, the pack-saddle). The stretcher can also be readily fastened to a mountain *sledge*, or to a *cart*, or slung across a mountain torrent, or crevasse, or other obstacle, by means of an improvised *crane*, and all these various methods of transport can be carried out without once removing the patient from the stretcher, from the time that he is first picked up until he finally reaches the hospital.

J. E. NICHOLSON,
Lieutenant-Colonel (R.P.).

Some Observations on the Breeding Ground of the Common House-fly.—In the *Indian Medical Gazette* for September, 1906, Captain G. D. Franklin, I.M.S., records the results of a series of experiments, covering a

period of nine months, with a view to determining the breeding ground of *Musca*, the common house-fly. The material experimented with was selected either because it actually contained larvæ, or, because in the situation from which the material was taken, flies were found in large numbers. The author observed early in the experiments that if the material selected was allowed to get dry, or if too dry material was selected originally, the experiment gave a negative result. The cantonment trenching in Shillong is carried out on the top of a hill, which has a very dry and sandy soil. This accounts, he thinks, for the negative result obtained in all the experiments carried out with material from this trenching ground. Four experiments were also made with night-soil, which had been trenched, and after a month dug up and exposed to the air for forty-eight hours. Partial disintegration had taken place, but it was still moist when first exposed. However, it apparently either dried too rapidly after exposure, or else had lost some special constituent or constituents, as it failed to serve as a breeding ground, and the four experiments gave a negative result. At the same time, material taken from various places where latrine buckets were washed, and where there would be night-soil in a very liquid condition, in every experiment yielded positive results, *Musca*, the house-fly, being hatched out. This, he thinks, would lead one to suppose that night-soil was the material in which the house-fly commonly breeds, and that these other situations were only feeding grounds. With a view to testing this supposition, some night-soil was taken straight from latrine buckets and collected into a large flat receptacle and exposed to the air. This night-soil was found to be swarming with larvæ in four days' time. The larvæ were about .42 of an inch long, yellowish in colour, extremely active, but with no distinct head. These larvæ became pupæ within a period of thirty-six hours to one week. These pupæ were about .3 of an inch long, of a light brown colour at first, gradually becoming darker till they were finally a deep dark brown. The puparium was opaque, thick and brittle. At the cut surface a soft, tissue-paper-like inner coat could be distinguished. In eight days' time a fly emerged through a circular opening in the anterior end of the puparium. In the case of this same fly exactly eight days elapsed in the pupal stage in three other experiments. On examination, this fly was seen to be black with yellowish markings, and was of the size of the common house-fly. The aristæ were flumose; the proboscis rounded and not adapted for piercing. The curvature of the fourth vein was angular. The halteres were covered with a squama. The abdomen was composed of four indistinct segments, yellowish in colour and non-metallic. These are the characteristics of *Musca*, the common house-fly. Numerous experiments were made with material from other situations where *Musca* abounds, but they were, almost without exception, negative so far as this particular species was concerned.

Captain Franklin states that, so far as the experiments have been carried out to the present, they go to show that the breeding place of the common house-fly is in night-soil, and that these other places, such as refuse heaps, &c., where the imago abounds, are only their feeding grounds. In the light of these facts and bearing in mind the capability of these flies of conveying bacteria, it would appear desirable to inhibit their growth as much as possible; for although one cannot say definitely

that the common house-fly breeds only in night-soil, at any rate it breeds in great profusion in it, and not in other situations where one would expect it to. He found that if night-soil was spread out thinly on a tray and allowed to dry quickly, that no growth occurred, and that even if the night-soil so experimented with already contained larvæ, these died when the night-soil became dry. The addition of lime or perchloride of mercury also inhibited the breeding. With a view to at any rate diminishing the number of these flies, and at the same time lessening the dangers which they, with their power of conveying bacteria, threaten, the treatment of all night-soil with either lime or perchloride of mercury, both of which are equally efficacious, seems to be a measure worthy of consideration. He thinks it too early in these experiments to lay down hard and fast rules, but considers that there is sufficient evidence to state that the common house-fly breeds in great profusion in night-soil, and not in the vicinity of cook-houses, &c., where it is to be found in such vast numbers; these latter situations being, apparently, only its feeding grounds.

These experiments of Captain Franklin's are important, as the natural history of the common house-fly ought to be thoroughly investigated. It is remarkable how little is known of its breeding habits, although the adult flies are so numerous. As there are several species of house-flies, it would be well if the specific name is given, and Captain Franklin's attention might be drawn to a paper by Ernest E. Austen, in the ROYAL ARMY MEDICAL CORPS JOURNAL, June, 1904.

Correspondence.

THE THERMAL DEATH POINT OF PATHOGENIC BACTERIA AND THE "PORTABLE (ARMY) EXCRETA STERILISER."

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In the current number of the Journal (September, 1906), which I have just received, are two interesting papers dealing with the "Griffith" water steriliser, by Lieutenant-Colonel R. H. Firth, R.A.M.C., and Dr. Griffith, respectively.

Dr. Griffith quotes the opinions of five recognised authorities regarding the thermal death point of the *B. typhosus abdominalis*. Three of the five consider that exposure for ten minutes to a temperature of 60° C, or even lower (50° and 56° C.), is sufficient to destroy it. Dr. Griffith's own experiments also go to prove that pathogenic bacteria in general are readily destroyed by exposure to temperatures a long way below boiling point for a few seconds. They are, in fact, even less resistant to this agent than has been generally supposed.

In the November number of the Journal for 1905 I described a simple and practical apparatus for the sterilisation of excreta under all conditions of military life, which I have named "the portable (Army) excreta steriliser." The sterilisation (of pathogenic bacteria) is effected by raising the temperature of the sewage to 60° C. for thirty minutes. It appears to me, however, that a temperature of 55° C., maintained for fifteen minutes, would be amply sufficient. This is all to the advantage of the process, as it means that the work can be done more quickly and even more cheaply than my estimate shows. I believe that the most economical and most generally applicable conservancy methods we can adopt in India, that will, at the same time, give the British soldier protection from the enteric fever scourge, are :—

- (1) To abolish the use of dry-earth entirely in the latrines.
- (2) To substitute a weak antiseptic solution, viz., crude carbolic acid, half an ounce to the gallon.
- (3) The pans to be filled two-thirds full every morning with this solution, and emptied when requisite, but not every time they are used, as this is wasteful and unnecessary.
- Only a weak carbolic solution is required, as the object is not to attempt to sterilise the excreta, but (i.) to prevent access of flies; (ii.) to counteract putrefaction, and (iii.) to lower resistance of the sewage bacteria.
- (4) Empty the pans directly into the chamber of the steriliser, thus doing away with the objectionable receptacles.
- (5) The "portable (Army) excreta steriliser" should be placed in the enclosure which is always to be found on one side of the latrine block.
- (6) Sterilisation should be carried on at fixed hours during the day, and the sterilised sewage be emptied at once.
- (7) Institute day removal at fixed hours.

Night removal should be absolutely forbidden, as it means the conveyance of gallons of dangerous material through the cantonment without proper supervision.¹ The only real objection to day removal is the horrible stench given forth from the Crowley carts. This stench alone condemns the dry-earth method, as it shows how little deodorant power dry-earth possesses. There will be no stench if the system I suggest is instituted.

(8) Abandon shallow trenching, whether of the Allahabad or the Thornhill pattern. Trenches to be three feet deep and to be filled in when within twelve inches of the surface.

I object to shallow trenching for the following reasons: (i.) it is

¹ Of course, if "practical" sterilisation of the excreta is effected by the "hot wet" process I have advocated, the chief objection to night removal disappears. Nevertheless, I recommend day removal as an additional safeguard, acting on the same principle as the careful householder who has bolts placed on the door which is already provided with a lock. The same reason leads me to favour the deep trench even for sterilised sewage.

dangerous to attempt to make your conservancy system a successful commercial enterprise, as safety is likely to be sacrificed for the sake of profit; (ii.) it is a mistake to rely upon an agent, the physical conditions of which are liable to such great variations as the soil, to convert the often dangerous sewage into harmless and valuable manure without danger to the health of the community. The sewage should be made harmless before it is committed to the ground; to do otherwise is to lean for safety on the broken reed of chance, instead of on the iron staff of science.

I am, &c.

S. GLENN ALLEN,

Lieutenant-Colonel, R.A.M.C

*Kalabagh, Hazara,
Punjab.*

September 25th, 1906.

THE EMPLOYMENT OF NON-COMMISSIONED OFFICERS AND MEN OF THE ROYAL ARMY MEDICAL CORPS IN INDIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—I am addressing this to you in the hope that other officers of the Corps may be induced to ventilate their opinions on the above subject.

The present system in vogue in India of employing soldiers from the units in garrison as nursing orderlies is out of date, unsuitable in every way, and has many grave disadvantages from the point of view of the regimental officer, the medical officer, and the man himself. The regimental officer, often at his wits' end to get through the amount of work called for from him in these strenuous times, is hardly to be blamed if the men he sends to hospital as orderlies are not noted for intelligence. They are, in fact, too often the men whom he can best spare, *i.e.*, the most useless and lazy. Of course, there are many excellent nurses among the regimental nursing orderlies—men who seem to have hit upon their vocation, so to speak. These men prefer to remain as nurses, take an interest in their work, and can be properly trained. But, unfortunately, a large number of men do not care for the work, and their one object is to get back to duty again. Another great disadvantage of the system is that the hospital orderly is constantly being changed; no sooner has he been partially trained than he returns to duty to go through, say, a course of musketry, or what not, and a raw man is sent in his place, who has to be trained all over again from the beginning. The consequence of this is that there are always a number of partially-trained men doing duty as nurses, who are often, owing to pressure of work, called upon to do duties which could only be properly

carried out by a highly-trained man. The results of this are sometimes disastrous. Owing to the shortage of Army nursing sisters in India, the rôle of nursing orderly is even of more importance than at home. To a man who does not take an interest in nursing, the duties he has to perform are often disagreeable and irksome; besides this, he often loses his "efficiency" pay by becoming an "orderly," and does not work hard enough to qualify for extra pay as a nurse; the result is that he is careless and not to be depended on.

India is a good country to serve in, and would be popular with the non-commissioned officers and men of the Corps. The extra expense entailed would be more than compensated for by the advantages accruing to all concerned.

I am, &c.

G. A. KEPPEL H. REED,

Captain, R.A.M.C.

Nougong,

Central India,

August 11th, 1906.

INDEX TO VOL. VII.

	PAGE		PAGE
Abscess, hepatic, with rupture into the right pleural cavity, case of, by Capt. G. A. K. H. Reed, clinical and other notes	606	Austin, Major R. F. E., respiratory training for the soldier, correspondence	528
Algeria, a holiday trip in, by Major F. W. Begbie, travel	286	<i>B. pestis</i> , on the date of appearance and duration of, in the peripheral blood of cases of bubonic plague in India, by Capt. E. D. W. Greig ..	34
Allen, Lieut.-Col. S. G., incontinence of urine in the soldier	336	<i>B. typhosus</i> , on the action of cold or lukewarm tea on, by Major J. G. McNaught	372
Allen, Lieut.-Col. S. G., the thermal death point of pathogenic bacteria and the "portable (Army) excreta steriliser," correspondence	633	Bacteriology of a series of cases of sore throat, note on the, by Major J. G. McNaught	211
Alpine stretcher, a new, current literature	631	Barratt, Lieut.-Col. H. J., the health of the soldier, with special reference to preventable diseases	116
Anatomy, the internal, of Stomoxys, by the late Lieut. F. M. G. Tulloch ..	154	Base of operations in war time, on the medical organisation of the, by Surg.-General G. J. H. Evatt, echoes from the past	73, 188
Aneurysm, innominate, simultaneous ligature of right carotid and subclavian arteries, recovery, by Major H. N. Dunn, clinical and other notes	397	Bassett-Smith, Fleet-Surgeon P. W., examination of the blood of patients to determine if other than Malta fever sera would agglutinate the <i>M. melitensis</i> , reports of the Commission on Malta fever	13
Aneurysm, saccular, a case of rupture of, of the first part of the aorta, by Capt. N. J. C. Rutherford, clinical and other notes	283	Bateman, Capt. H. R., and Lieut.-Col. C. Birt, kala-azar	341
Anthrax, notes, mainly <i>post-mortem</i> , on a case of, in a soldier, by Capt. L. W. Harrison, clinical and other notes	502	Battersby, Lieut.-Col. H. L., and Lieut.-Col. J. R. Dodd, the Ghurkha "khud" race, travel	408
Antiseptic procedure, the, and after-treatment of patients, at the Rotunda Hospital, Dublin, by Capt. R. H. Fuhr, clinical and other notes ..	172	Begbie, Major F. W., a holiday trip in Algeria, travel	286
Anti-typhoid inoculation, memorandum regarding, by Capt. W. S. Harrison	63	Beggs, Capt. S. T., rôle and training of the R.A.M.C. Militia	591
Arrangements, medical, in war, essay on, by Lieut.-Col. C. W. S. Magrath	455	Béveridge, Major W. W. O., the inspection of tinned foods	137
Artery, radial, rupture of the, caused by a blow, a case of, by Major E. M. Morphey, clinical and other notes	603	Bilharzia, report on five cases of, by Lieut.-Col. D. Wardrop, clinical and other notes	282
Austin, Major R. F. E., defects of the present system of respiratory training for the soldier, with hints towards its improvement	376	Birrell, Capt. E. T. F., a note on the use of lime juice in enteric fever, clinical and other notes	177

	PAGE		PAGE
Birt, Lieut.-Col. C., and Capt. H. R. Bateman, kala-azar	341	Chyluria, current literature	207
Birt, Lieut.-Col. C., on the treatment of enteric fever with typhoid vaccine	271	Clarke, Capt. F. A. H., motor cycles in India, travel	401
Blackwater fever, two cases of, by Capt. H. Ensor, clinical and other notes	387	Collargol, treatment of Mediterranean fever with, current literature	416
Blackwell, Lieut.-Col. C. T., a case of small-pox, clinical and other notes	395	Continental surgical procedure, some notes on, by Capt. F. F. Carroll	255
Bliss, Capt. E. W., a case of recurrent dislocation of the left humerus, clinical and other notes	507	Copeland, Major R. J., and Major F. Smith, malarial fever contracted in Portsmouth, clinical and other notes	186
Blood, examination of the, of patients to determine if other than Malta fever sera would agglutinate the <i>M. melitensis</i> , by Fleet-Surgeon P. W. Bassett-Smith, reports of the commission on Malta fever	13	Croly, Capt. W. C., and Capt. A. H. Waring, notes on a case of extensive fracture of the skull, followed by middle meningeal hæmorrhage, clinical and other notes	601
Blood, the determination of typhoid bacilli in the, current literature	87	Cummins, Capt. S. L., kala-azar, and its intermediate host, a suggestion, clinical and other notes	393
Bousfield, Lieut. L., a case of Malta fever with ulceration of the small intestine, clinical and other notes	174	Cycle-stretcher, Chavernac's, for the removal of the seriously wounded, current literature	208
Bousfield, Lieut. L., some remarks on protective inoculation against Malta fever, clinical and other notes	179	Davies, Lieut.-Col. A. M., report on the prevalence of Mediterranean fever amongst British troops in Malta, 1905, reports of the commission on Malta fever 93, 245, 307, 419, 547	
Brillantgrün, on the action of, on <i>T. brucei</i> , current literature	88	Delhi boil, tropical sore or, current literature	299
Bruce, Col. D., South African stock diseases	22, 145, 236	Dextrocardia, complete, case of, by Capt. J. H. P. Graham, clinical and other notes	498
Bruce, Lieut. and Qrmr. F., hints regarding the management and use of X-ray apparatus	17, 163, 266, 380	"Diagnosis, surgical aids to," review of	206
Bubonic plague in India, on the date of appearance and duration of <i>B. pestis</i> in the peripheral blood of cases of, by Capt. E. D. W. Greig	34	Diarrhœa, report on an outbreak of, at the X Depot Barracks, England, April, 1906, by Lieut.-Col. J. V. Salvage	441
Bullet wounds, the mutual mobility between the skin and deeper structures and its relation to, by G. Lenthal Cheatle	31	Diphtheria in the British Army, remarks on the history and prevalence of, by Major F. Smith	348
Carmichael, Capt. D. G., an interesting case of marginal placenta prævia, clinical and other notes	598	"Disease, war with," reviews of 523, 524	
Carroll, Capt. F. F., some notes on continental surgical procedure	255	Dislocation, recurrent, of the left humerus, a case of by Capt. E. W. Bliss, clinical and other notes	507
Cheatle, G. Lenthal, the mutual mobility between the skin and deeper structures, and its relation to bullet wounds	31	Dislocation, recurrent, report on twelve cases of removal of internal semilunar cartilage for, by Major F. J. W. Porter, clinical and other notes	615
Chrome leather, a suitable material for soldiers' boots, by Lieut.-Col. R. Kirkpatrick, clinical and other notes	385	Dodd, Lieut.-Col. J. R., and Lieut.-Col. H. L. Battersby, the Ghurka "khud" race, travel	408

	PAGE		PAGE
Drinking water, neutral red and the rapid diagnosis of the pollution of, by the <i>B. coli</i> , current literature ..	415	Erythema nodosum (nodal fever), by Major C. W. R. Healey, clinical and other notes	68
Dudding, Lieut. T. S., and Capt. J. W. West, a case of enteric fever with spontaneous rupture of the spleen, clinical and other notes	183	Evatt, Surg.-General G. J. H., on the medical organisation of the base of operations in war time, echoes from the past	73, 188
Dunn, Major H. N., innominate aneurysm, simultaneous ligature of right carotid and subclavian arteries, recovery, clinical and other notes ..	397	Exton, Lieut. and Qrmr. T., R.A.M.C. Gazetteer, correspondence	528
Dysentery, notes on six consecutive cases of, treated by anti-dysenteric serum, by Lieut. S. E. Lewis, clinical and other notes	510	Fallon, Lieut.-Col. J., some unclassified parasites which affect the soldier in India	589
Echoes from the past, on the medical organisation of the base of operations in war time, by Surg.-General G. J. H. Evatt	73, 188	Firth, Lieut.-Col. R. H., enteric fever: a water-borne disease, correspondence	89
Edye, Major J. S., a case of simple fracture of the vault of the skull, clinical and other notes	609	Firth, Lieut.-Col. R. H., the Griffith water steriliser	218
Ensor, Capt. H., two cases of black-water fever, clinical and other notes	387	Forman, Col. R. H., and Capt. R. Selby, on the symptomatic treatment of enteric fever	446
Enteric fever, a case of, with spontaneous rupture of the spleen, by Capt. J. W. West and Lieut. T. S. Dudding, clinical and other notes ..	183	Forman, Col. R. H., Indian enteric and latrines, correspondence ..	304
Enteric fever, a note on the use of lime juice in, by Capt. E. T. F. Birrell, clinical and other notes	177	Forman, Col. R. H., the humour of Indian sanitation	259
Enteric fever: a water-borne disease, letter from Lieut.-Col. R. H. Firth, correspondence	89	Foulds, Capt. M. F., a little-known treatment for sunstroke, clinical and other notes	604
Enteric fever in natives of India, by Major W. T. Mould, clinical and other notes	279	Fracture of the skull, extensive, notes on a case of, followed by middle meningeal hæmorrhage, by Capt. A. H. Waring and W. C. Croly, clinical and other notes	601
Enteric fever: is it invariably a water-borne disease? by Surg.-General R. H. Quill	232	Fracture of the vault of the skull, a case of simple, by Major J. S. Edye, clinical and other notes	609
Enteric fever, on the symptomatic treatment of, by Col. R. H. Forman and Capt. R. Selby	446	Fuhr, Capt. R. H., the antiseptic procedure, and after-treatment of patients, at the Rotunda Hospital, Dublin, clinical and others notes ..	172
Enteric fever, on the treatment of, with typhoid vaccine, by Lieut.-Col. C. Birt	271	Fuhr, Capt. R. H., the sub-cuticular suture and leaden plate, as used in the Rotunda Hospital, Dublin, clinical and other notes	178
Enteric, Indian, and latrines, letter from Col. R. H. Forman, correspondence	304	Gazetteer, R.A.M.C., letter from Lieut. and Qrmr. T. Exton, correspondence	528
Erythema multiform of the iris type, a case of, by Capt. H. J. McGrigor, clinical and other notes	509	Ghurkha "khud" race, the, by Lieut.-Cols. J. R. Dodd and H. L. Battersby, travel	408
		Glanvill, Lieut. E. M., a case of gunshot wound of the head, clinical and other notes	516

	PAGE		PAGE
<i>Glossina palpalis</i> in its relation to <i>Trypanosoma gambiense</i> and other trypanosomes (preliminary report), by Professor E. A. Minchin and Lieuts. A. C. H. Gray and the late F. M. G. Tulloch	568	Hammer toe and hallux valgus, letters from Lieut.-Col. G. F. Poynder, correspondence	91, 92, 527
Goats, cows, and other animals, Mediterranean fever in, by Staff-Surgeon E. A. Shaw, reports of the Commission on Malta fever	1	Hammer toe, letter from Capt. A. J. Hull, correspondence	305
Gonorrhœa, the local treatment of, by Dr. J. S. Purdy, clinical and other notes	504	Hand-grenades, the, of the Japanese army, current literature	208
Gonorrhœa, the treatment of, by Capt. N. E. Harding, clinical and other notes	386	Harding, Capt. N. E., the treatment of gonorrhœa, clinical and other notes	386
Graham, Capt. J. H. P., notes on a case of complete dextrocardia, clinical and other notes	498	Harrison, Capt. L. W., a rapid and practical method of diagnosing typhoid fever	126
Grattan, Capt. H. W., a note on trypanosomiasis in Sierra Leone	485	Harrison, Capt. L. W., notes, mainly <i>post-mortem</i> , on a case of anthrax in a soldier, clinical and other notes	502
Gray, Lieut. A. C. H., and the late Lieut. F. M. G. Tulloch, an experiment on the cultivation of <i>T. gambiense</i>	580	Harrison, Capt. W. S., memorandum regarding anti-typhoid inoculation	63
Gray, Lieut. A. C. H., Professor E. A. Minchin, and the late Lieut. F. M. G. Tulloch, <i>Glossina palpalis</i> in its relation to <i>Trypanosoma gambiense</i> and other trypanosomes (preliminary report)	568	Harrison, Capt. W. S., on the phagocytosis of typhoid bacteria	322
Gray, Lieut. A. C. H., some notes on a <i>Herpetomonas</i> found in the alimentary tract of <i>Stomoxys (calci-trans?)</i> in Uganda	581	Hassard, Major E. M., the last moments of Lord Nelson, echoes from the past	520
Greig, Capt. E. D. W., on the date of appearance and duration of <i>B. pestis</i> in the peripheral blood of cases of bubonic plague in India	34	Hathaway, Lieut.-Col. H., the disposal of the wounded of mounted troops	374
Greig, Capt. E. D. W., the study of tropical disease, scheme for Indian research, correspondence	302	Healey, Major C. W. R., erythema nodosum (nodal fever), clinical and other notes	68
Griffith, Dr. P. G., heat as a means of purifying water	226	Health, preservation of, amongst the <i>personnel</i> of the Japanese army, by Baron Takaki	54
Griffith water sterilisers, the, by Lieut.-Col. R. H. Firth	218	Heart, valvular disease of the, in British and native troops, &c., in India, by Lieut.-Col. R. R. H. Moore	328
"Guide to promotion for N.C.O.'s and men of the R.A.M.C.," review of	296	Heat as a means of purifying water, by Dr. P. G. Griffith	226
Gunshot wound of the head, a case of, by Lieut. E. M. Glanvill, clinical and other notes	516	Hepatic abscess, case of, with rupture into the right pleural cavity, by Capt. G. A. K. H. Reed, clinical and other notes	606
		Hernia, femoral and inguinal, on the same side, report of a case of, in which radical cure of the former was done by a new method, by Major F. J. W. Porter, clinical and other notes	515
		Hernia, operation on intending recruits suffering from, letter from Major F. J. W. Porter, correspondence	306

	PAGE		PAGE
Herpetomonas, some notes on a, found in the alimentary tract of <i>Stomoxys (calcitrans?)</i> in Uganda, by Lieut. A. C. H. Gray	581	Innominate aneurysm, simultaneous ligature of right carotid and sub-clavian arteries, recovery, by Major H. N. Dunn, clinical and other notes	397
Herrick, Capt. H., rupture of liver due to a fall, clinical and other notes ..	281	Inoculation, anti-typhoid, memorandum regarding, by Capt. W. S. Harrison	63
Hill, C. A., on the preparation of a satisfactory mercurial cream for intramuscular injection	43	Inoculation, protective, against Malta fever, some remarks on, by Lieut. L. Bousfield, clinical and other notes	179
Hill warfare, the removal of wounded in, by Capt. W. W. Jeudwine	134	Inspection, the, of tinned foods, by Major W. W. O. Beveridge	137
Holiday trip in Algeria, a, by Major F. W. Begbie, travel	286	Internal semilunar cartilage, removal of, for recurrent dislocation, report on twelve cases of, by Major F. J. W. Porter, clinical and other notes	615
Horse-sickness in the Aden hinterland, letter from Capt. A. C. Ingram, correspondence	530	International Congress at Lisbon, the, 1906, by Col. A. T. Sloggett, travel ..	618
House-fly, common, some observations on the breeding-ground of the, current literature	631	Intramuscular injection, on the preparation of a satisfactory mercurial cream for, by C. A. Hill	43
Hudleston, Capt. W. E., further note on the systematic treatment of malaria amongst European troops ..	50	Invaliding for tuberculosis, suggestion for the probable reduction of the rate of, by Lieut. W. C. Rivers, clinical and other notes	66
Hull, Capt. A. J., hammer toe, correspondence	305	Iodide of potassium, iodipin as a substitute for, by Col. F. J. Lambkin, clinical and other notes	71
Human tick fever, current literature ..	86	Iodipin as a substitute for potassium iodide, by Col. F. J. Lambkin, clinical and other notes	71
Humerus, left, a case of recurrent dislocation of the, by Capt. E. W. Bliss, clinical and other notes ..	507	Japanese Army, preservation of health amongst the <i>personnel</i> of the, by Baron Takaki	54
Humour of Indian sanitation, the, by Col. R. H. Forman	259	Japanese Army, the hand-grenades of the, current literature	208
Ievers, Major P. G., rider's sprain ..	131	Japanese medical services in the Russo-Japanese war, address on the, by Surgeon-Lieut.-General M. Koike, translation	624
Incontinence of urine in the soldier, by Lieut.-Col. S. G. Allen	336	Jeudwine, Capt. W. W., the removal of wounded in hill warfare	134
India, some unclassified parasites which affect the soldier in, by Lieut.-Col. J. Fallon	589	Kala-azar and its intermediate host, a suggestion, by Capt. S. L. Cummins, clinical and other notes ..	393
India, the employment of N.C.O.'s and men of the R.A.M.C. in, letter from Capt. G. A. K. H. Reed, correspondence	635	Kala-azar, by Lieut.-Col. C. Birt and Capt. H. R. Bateman	341
Indian enteric and latrines, letter from Col. R. H. Forman, correspondence ..	304	Keeping a pony, by Lieut. W. C. Rivers, travel	517
Indian research, scheme for, the study of tropical disease, letter from Capt. E. D. W. Greig, correspondence ..	302		
Indian sanitation, the humour of, by Col. R. H. Forman	259		
Indian service for all ranks of the Corps, a plea for, by Major W. Tibbits	39		
Ingram, Capt. A. C., horse-sickness in the Aden hinterland, correspondence	530		

	PAGE		PAGE
"Khud" race, the Ghurkha, by Lieut.-Col. J. R. Dodd and H. L. Battersby, travel	408	Malaria amongst European troops, further note on the systematic treatment of, by Capt. W. E. Hudleston	50
"Kidney capsulotomy, the urethrotomies and," review of	522	Malarial fever contracted in Portsmouth, by Majors R. J. Copeland and F. Smith, clinical and other notes	186
Kirkpatrick, Lieut.-Col. R., chrome leather, a suitable material for soldiers' boots, clinical and other notes	385	Malignant pustule, a case of, by Capt. J. Tobin, clinical and other notes	71
Koike, Surgeon-Lieut.-General M., address on the Japanese Medical Services in the Russo-Japanese war, translation	624	Malta fever, a case of, with ulceration of the small intestine, by Lieut. L. Bousfield, clinical and other notes	174
Lambkin, Col. F. J., dosage of metallic mercury in intramuscular treatment of syphilis	65	Malta fever, examination of the blood of patients, to determine if other than Mediterranean fever sera would agglutinate the <i>M. melitensis</i> , by Fleet-Surgeon P. W. Bassett-Smith, reports of the Commission on Malta fever	13
Lambkin, Col. F. J., iodipin as a substitute for potassium iodide, clinical and other notes	71	Malta fever in goats, cows, and other animals, by Staff-Surgeon E. A. Shaw, reports of the Commission on Malta fever	1
Latrines, Indian enteric and, letter from Col. R. H. Forman, correspondence	304	Malta fever, prevalence of, amongst British troops in Malta, 1905, report on the, by Lieut.-Col. A. M. Davies, reports of the Commission on Malta fever	93, 245, 307, 419, 547
Lawson, Major C. B., notes on a case of acute yellow atrophy of the liver, clinical and other notes	500	Malta fever, reports of the Commission on	1, 93, 245, 307, 419, 547
Lawson, Major C. B., notes on a case of a rare form of volvulus, clinical and other notes	593	Malta fever, some remarks on protective inoculation against, by Lieut. L. Bousfield, clinical and other notes	179
Leaden plate, the, and the sub-cuticular suture, as used in the Rotunda Hospital, Dublin, by Capt. R. H. Fuhr, clinical and other notes	178	Malta fever, treatment of, with collar-gol, current literature	416
Lewis, Lieut. S. E., notes on six consecutive cases of dysentery treated by anti-dysenteric serum, clinical and other notes	510	Mangin, Major F. M., the causation and prevention of the spread of yellow fever	369
"Life, on means for the prolongation of," review of	413	Marginal placenta prævia, an interesting case of, by Capt. D. G. Carmichael, clinical and other notes	598
Lime juice, a note on the use of, in enteric fever, by Capt. E. T. F. Birrell, clinical and other notes	177	McGill, Lieut.-Col. H. S., the sanitation of transports	472
Lisbon, the International Congress at, 1906, by Col. A. T. Sloggett, travel	618	McGrigor, Capt. H. J., a case of erythema multiform of the iris type, clinical and other notes	509
Liver, acute yellow atrophy of the, notes on a case of, &c., by Major C. B. Lawson, clinical and other notes	500	McNaught, Major J. G., note on the bacteriology of a series of cases of sore throat	211
Liver, rupture of, due to a fall, by Capt. H. Herrick, clinical and other notes	281	McNaught, Major J. G., on the action of cold or lukewarm tea on <i>B. typhosus</i>	372
"Liverpool School of Tropical Medicine, Memoir XVIII.," review of	412		
Magrath, Lieut.-Col. C. W. S., essay on medical arrangements in war	455, 531		

	PAGE		PAGE
Medical arrangements in war, essay on, by Lieut.-Col. C. W. S. Magrath	455, 531	Minchin, Professor E. A., and Lieuts. A. C. H. Gray and the late F. M. G. Tulloch, <i>Glossina palpalis</i> in its relation to <i>Trypanosoma gambiense</i> and other trypanosomes (preliminary report)	568
Medical organisation, on the, of the base of operations in war time, by Surg.-General G. J. H. Evatt, echoes from the past.. ..	73, 188	Moore, Lieut.-Col. R. R. H., valvular disease of the heart in British and native troops, &c., in India	328
Mediterranean fever, a case of, with ulceration of the small intestine, by Lieut. L. Bousfield, clinical and other notes	174	Morphew, Major E. M., a case of rupture of the radial artery caused by a blow, clinical and other notes	603
Mediterranean fever, examination of the blood of patients, to determine if other than Malta fever sera would agglutinate the <i>M. melitensis</i> , by Fleet-Surgeon P. W. Bassett-Smith, reports of the Commission on Malta fever	13	Motor cycles in India, by Capt. F. A. H. Clarke, travel	401
Mediterranean fever in goats, cows, and other animals, by Staff-Surgeon E. A. Shaw, reports of the Commission on Malta fever	1	Mould, Major W. T., enteric fever in natives of India, clinical and other notes	279
"Mediterranean fever in Tunis," review of	84	Nagana trypanosomes, temporary disappearance of, in infected dogs, current literature	526
Mediterranean fever, prevalence of, amongst British troops in Malta, 1905, report on the, by Lieut.-Col. A. M. Davies, reports of the Commission on Malta fever	93, 245, 307, 419, 547	Nelson, Lord, the last moments of, by Major E. M. Hassard, echoes from the past.. .. .	520
Mediterranean fever, reports of the Commission on 1, 93, 245, 307, 419, 547		Neutral red and the rapid diagnosis of the pollution of drinking water by the <i>B. coli</i> , current literature	415
Mediterranean fever, some remarks on protective inoculation against, by Lieut. L. Bousfield, clinical and other notes	179	(Nodal fever) erythema nodosum, by Major C. W. R. Healey, clinical and other notes	68
Mediterranean fever, treatment of, with collargol, current literature	416	Parasites, unclassified, some, which affect the soldier in India, by Lieut.-Col. J. Fallon	589
Mercurial cream for intramuscular injection, on the preparation of a satisfactory, by C. A. Hill	43	Pearse, Major A., preventive medicine in the Army	584
Mercurial cream, sterility of, clinical and other notes	394	Peritonitis, general, a Case of, following abscess of the liver, by Lieut. T. J. Wright, clinical and other notes	599
Mercury, metallic, dosage of, in intramuscular treatment of syphilis, by Col. F. J. Lambkin	65	Phagocytosis of typhoid bacteria, on the, by Capt. W. S. Harrison	322
"Military sanitation, notes on," review of	85	Physical training, observation on, recruiting, Northern Command, by Lieut.-Col. S. Westcott, clinical and other notes	72
Militia, R.A.M.C., rôle and training of the, by Capt. S. T. Beggs	591	Placenta prævia, marginal, an interesting case of, by Capt. D. G. Carmichael, clinical and other notes	598
		Plague, bubonic, in India, on the date of appearance and duration of <i>B. pestis</i> in the peripheral blood of cases of, by Capt. E. D. W. Greig	34

	PAGE		PAGE
Plague, the serum-treatment of, current literature.. .. .	298	Reed, Capt. G. A. K. H., case of hepatic abscess, with rupture into the right pleural cavity, clinical and other notes	606
Pony, keeping a, by Lieut. W. C. Rivers, travel	517	Reed, Capt. G. A. K. H., the employment of N.C.O.'s and men of the R.A.M.C. in India, correspondence..	635
Porter, Major F. J. W., recruiting: operation on intending recruits suffering from hernia, correspondence	306	Reed, Capt. G. A. K. H., a case of malignant disease of the thoracic wall, &c., clinical and other notes ..	398
Porter, Major F. J. W., report of a case of femoral and inguinal hernia on the same side, in which radical cure of the former was done by a new method, clinical and other notes	515	Respiratory training for the soldier, defects of the present system of, with hints towards its improvement, by Major R. F. E. Austin	376
Porter, Major F. J. W., report on twelve cases of removal of internal semilunar cartilage for recurrent dislocation, clinical and other notes	615	Respiratory training for the soldier, letter from Major R. F. E. Austin, correspondence	528
Poynder, Lieut.-Col. G. F., hammer toe and hallux valgus, correspondence	91, 92, 527	Review of tropical diseases, current literature	526
Preventable diseases, the health of the soldier, with special reference to, by Lieut.-Col. H. J. Barratt	116	REVIEWS:—	
Preventive medicine in the Army, by Major A. Pearse	584	“Aids to surgical diagnosis”	206
“Prolongation of life, on means for the,” review of	413	“Guide to promotion for N.C.O.'s and men of the R.A.M.C.”	296
“Promotion, guide to, for N.C.O.'s and men of the R.A.M.C.,” review of ..	296	“La fièvre Méditerranéenne en Tunisie”	84
Purdy, Dr. J. S., the local treatment of gonorrhœa, clinical and other notes	504	“Memoir XVIII., Liverpool School of Tropical Medicine”	412
Purifying water, heat as a means of, by Dr. P. G. Griffith	226	“Notes on military sanitation”	85
Pustule, malignant, a case of, by Capt. J. Tobin, clinical and other notes	71	“On means for the prolongation of life”	413
Quill, Surg.-General R. H., enteric fever: is it invariably a water-borne disease?	232	“Some lessons from the Russo-Japanese war”	296
Radial artery, rupture of the, caused by a blow, a case of, by Major E. M. Morphew, clinical and other notes..	603	“The operative treatment of prolapse and retroversion of the uterus”	411
Recruiting, Northern Command, observation on physical training, by Lieut.-Col. S. Westcott, clinical and other notes	72	“The ship surgeon's handbook”	411
Recruiting: operation on intending recruits suffering from hernia, letter from Major F. J. W. Porter, correspondence	306	“The urethrotomies and kidney capsulotomy”	522
		“War with disease”	523, 524
		“Yellow fever prophylaxis in New Orleans, 1905 (Liverpool School of Tropical Medicine, Memoir XIX.)”	205
		Rider's sprain, by Major P. G. Ievers	131
		Rivers, Lieut. W. C., a suggestion for the probable reduction of the rate of invaliding for tuberculosis, clinical and other notes	66
		Rivers, Lieut. W. C., keeping a pony, travel	517
		R.A.M.C. Gazetteer letter from Lieut. and Qrmr. T. Exton, correspondence	528

	PAGE		PAGE
R.A.M.C. in India, the employment of N.C.O.'s and men of the, letter from Capt. G. A. K. H. Reed, correspondence	635	Shaw, Staff-Surgeon E. A., Mediterranean fever in goats, cows, and other animals, reports of the Commission on Malta fever	1
R.A.M.C. militia, rôle and training of the, by Capt. S. T. Beggs	591	"Ship surgeon's handbook, the," review of	411
Rotunda Hospital, Dublin, the antiseptic procedure, and after-treatment of patients, at the, by Capt. R. H. Fuhr, clinical and other notes ..	172	Sierra Leone, a note on trypanosomiasis in, by Capt. H. W. Grattan ..	485
Rotunda Hospital, Dublin, the subcuticular suture and leaden plate, as used in the, by Capt. R. H. Fuhr, clinical and other notes	178	Sierra Leone, trypanosomiasis in, letter from Major F. Smith, correspondence	209
Rucker, Assistant-Surgeon W. C., the epidemiology of yellow fever ..	494	Skin and deeper structures, the mutual mobility between the, and its relation to bullet wounds, by G. Lenthal Cheatle	31
Rupture of liver due to a fall, by Capt. H. Herrick, clinical and other notes ..	281	Skull, extensive fracture of the, notes on a case of, followed by middle meningeal hæmorrhage, by Capt. A. H. Waring and W. C. Croly, clinical and other notes	601
"Russo-Japanese war, some lessons from the," review of	296	Skull, simple fracture of the vault of the, a case of, by Major J. S. Edye, clinical and other notes	609
Rutherford, Capt. N. J. C., case of rupture of saccular aneurysm of the first part of the aorta, clinical and other notes	283	Sleeping sickness, an experiment on the cultivation of <i>T. gambiense</i> , by Lieuts. A. C. H. Gray and the late F. M. G. Tulloch	580
Saccular aneurysm, a case of rupture of, of the first part of the aorta, by Capt. N. J. C. Rutherford, clinical and other notes	283	Sleeping sickness, <i>Glossina palpalis</i> in its relation to <i>Trypanosoma gambiense</i> and other trypanosomes (preliminary report), by Prof. E. A. Minchin and Lieuts. A. C. H. Gray and the late F. M. G. Tulloch ..	568
Salvage, Lieut.-Col. J. V., report on an outbreak of diarrhoea at the X Depôt Barracks, England, April, 1906	441	Sloggett, Col. A. T., the International Congress at Lisbon, 1906, travel ..	618
Sanitation, Indian, the humour of, by Col. R. H. Forman	259	Small-pox, a case of, by Lieut.-Col. C. T. Blackwell, clinical and other notes	395
"Sanitation, military, notes on," review of	85	Smith, Major F., and Major R. J. Copeland, malarial fever contracted in Portsmouth, clinical and other notes	186
Sanitation of transports, the, by Lieut.-Col. H. S. McGill	472	Smith, Major F., remarks on the history and prevalence of diphtheria in the British Army	348
Selby, Capt. R., and Col. R. H. Forman, on the symptomatic treatment of enteric fever	446	Smith, Major F., trypanosomiasis in Sierra Leone, correspondence ..	209
Serum, anti-dysenteric, note on six consecutive cases of dysentery treated by, by Lieut. S. E. Lewis, clinical and other notes	510	Soldier, the health of the, with special reference to preventable diseases, by Lieut.-Col. H. J. Barratt	116
Serum treatment of plague, the, current literature	298	Sore throat, note on the bacteriology of a series of cases of, by Major J. G. McNaught	211
Service, Indian, a plea for, for all ranks of the Corps, by Major W. Tibbits ..	39		
Severely wounded men, transport of, current literature	414		

	PAGE		PAGE
South African stock diseases, by Col. D. Bruce	22, 145, 236	Throat, sore, note on the bacteriology of a series of cases of, by Major J. G. McNaught	211
<i>Spirillum obermeieri</i> , studies on, and related organisms, current literature	417	Tibbits, Major W., a plea for Indian service for all ranks of the Corps ..	39
Sprain, rider's, by Major P. G. Ievers ..	131	Tick fever, human, current literature	86
Stalkartt, Major C. E. G., a case of obstruction of the superior vena cava by mediastinal new growth, clinical and other notes	384	Tinned foods, the inspection of, by Major W. W. O. Beveridge	137
Sterilisation, the thermal death point of pathogenic bacteria and the "portable (Army) excreta steriliser," letter from Lieut.-Col. S. G. Allen, correspondence	633	Tobin, Capt. J., a case of malignant pustule, clinical and other notes ..	71
Steriliser, water, the Griffith, by Lieut.-Col. R. H. Firth	218	Transport of severely wounded men, current literature	414
Sterility of mercurial cream, clinical and other notes	394	Transports, the sanitation of, by Lieut.-Col. H. S. McGill	472
Stock diseases, South African, by Col. D. Bruce	22, 145, 236	Treatment, symptomatic, of enteric fever, on the, by Col. R. H. Forman and Capt. R. Selby	446
Stomoxys, the internal anatomy of, by the late Lieut. F. M. G. Tulloch ..	154	Tropical disease, the study of, scheme for Indian research, letter from Capt. E. D. W. Greig, correspondence	302
Stretcher, a new Alpine, current literature	631	Tropical diseases, review of, current literature	526
Sunstroke, a little-known treatment for, by Capt. M. F. Foulds, clinical and other notes	604	Tropical sore or Delhi boil, current literature	299
Superior vena cava, a case of obstruction of the, by mediastinal new growth, by Major C. E. G. Stalkartt, clinical and other notes	384	Trypanosome, a new pathogenic, from the Upper Niger, current literature	525
"Surgical diagnosis, aids to," review of	206	<i>T. brucei</i> , on the action of brilliantgrün on, current literature	88
Surgical procedure, continental, some notes on, by Capt. F. F. Carroll ..	255	<i>T. gambiense</i> and other trypanosomes, <i>G. palpalis</i> in its relation to (preliminary report), by Professor E. A. Minchin and Lieuts. A. C. H. Gray and the late F. M. G. Tulloch ..	568
Suture, the sub-cuticular, and leaden plate, as used in the Rotunda Hospital, Dublin, by Capt. R. H. Fuhr, clinical and other notes	178	Trypanosomes, nagana, temporary disappearance of, in infected dogs, current literature	526
Syphilis, dosage of metallic mercury in intramuscular treatment of, by Col. F. J. Lambkin	65	Trypanosomiasis in Sierra Leone, a note on, by Capt. H. W. Grattan ..	485
		Trypanosomiasis in Sierra Leone, letter from Major F. Smith, correspondence	209
Takaki, Baron, the preservation of health among the <i>personnel</i> of the Japanese Army	54	Tuberculosis, invaliding for, suggestion for the probable reduction of the rate of, by Lieut. W. C. Rivers, clinical and other notes	66
Tea, on the action of cold or lukewarm, on <i>B. typhosus</i> , by Major J. G. McNaught	372	Tulloch, the late Lieut. F. M. G., the internal anatomy of Stomoxys ..	154
Thoracic wall, a case of malignant disease of the, &c., by Capt. G. A. K. H. Reed, clinical and other notes	398	Tulloch, the late Lieut. F. M. G., Professor E. A. Minchin and Lieut. A. C. H. Gray, <i>G. palpalis</i> in its relation to <i>T. gambiense</i> and other trypanosomes (preliminary report)	568

	PAGE		PAGE
Tulloch, the late Lieut. F. M. G., and Lieut. A. C. H. Gray, an experiment on the cultivation of <i>T. gambiense</i> ..	580	Water, heat as a means of purifying, by Dr. P. G. Griffith.. ..	226
Typhoid bacilli in the blood, the deter- mination of, current literature ..	87	Water steriliser, the Griffith, by Lieut.-Col. R. H. Firth	218
Typhoid bacteria, on the phagocytosis of, by Capt. W. S. Harrison ..	322	West, Capt. J. W. and Lieut. T. S. Dudding, a case of enteric fever with spontaneous rupture of the spleen, clinical and other notes	183
Typhoid fever, a rapid and practical method of diagnosing, by Captain L. W. Harrison	126	Westcott, Lieut.-Col. S., recruiting, Northern Command, observation on physical training, clinical and other notes	72
Typhoid vaccine, on the treatment of enteric fever with, by Lieut.-Col. C. Birt	271	Wound, gunshot, of the head, a case of, by Lieut. E. M. Glanville, clinical and other notes	516
"Urethrotomies, the, and kidney cap- sulotomy," review of	522	Wounded men, severely, transport of, current literature	414
Urine, incontinence of, in the soldier, by Lieut.-Col. S. G. Allen	336	Wounded of mounted troops, the dis- posal of the, by Lieut.-Col. H. Hathaway	374
"Uterus, the operative treatment of prolapse and retroversion of the," review of	411	Wounded, seriously, Chavernac's cycle- stretcher for the removal of the, current literature	208
Valvular disease of the heart in British and native troops, &c., in India, by Lieut.-Col. R. R. H. Moore ..	328	Wounded, the removal of, in hill war- fare, by Capt. W. W. Jeurwine ..	134
Volvulus, notes on a case of a rare form of, by Major C. B. Lawson, clinical and other notes	593	Wright, Lieut. T. J., a case of general peritonitis following abscess of the liver, clinical and other notes ..	599
Wardrop, Lieut.-Col. D., report on five cases of bilharzia, clinical and other notes	282	X-ray apparatus, hints regarding management and use of, by Lieut. and Qrmr. F. Bruce .. 17, 163, 266, 380	
Waring, Capt. A. H., and Capt. W. C. Croly, notes on a case of extensive fracture of the skull, followed by middle meningeal hæmorrhage, clinical and other notes	601	Yellow atrophy of the liver, acute, notes on a case of, &c., by Major C. B. Lawson, clinical and other notes	500
War, medical arrangements in, essay on, by Lieut.-Col. C. W. S. Magrath	455, 531	"Yellow fever prophylaxis in New Orleans, 1905 (Liverpool School of Tropical Medicine, Memoir XIX.)," review of	205
"War with disease," reviews of ..	523, 524	Yellow fever, the causation and pre- vention of the spread of, by Major F. M. Mangin	369
Water, drinking, neutral red and the rapid diagnosis of the pollution of, by the <i>B. coli</i> , current literature ..	415	Yellow fever, the epidemiology of, by Assistant-Surgeon W. C. Rucker ..	494

